Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2023

Pearson Edexcel Advanced Subsidiary In Biology (8BI0) Paper 02 Core Physiology And Ecology.

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Introduction

The AS paper 2 allowed candidates their second opportunity since 2019 to show their knowledge and understanding of the topics they have covered during their course. It also enabled them to apply this knowledge and understanding to new situations and novel contexts. Most candidates attempted all questions and there was no evidence of students being short of time. The examiners were pleased that all marks were achievable by candidates and a range of scores and attainment was observed on this summer's paper.

Question 1

(Q01 a) Asked candidates about the relationship between an organism's size and their relative dimensions. This item was intended to be a gentle introduction to the paper but only a few candidates were able to correctly identify the response.
In Q01(b) candidates did better with explaining why larger organisms need a mass transport system but smaller organisms do not. Most responses gained some credit with the best explaining that larger organisms have a smaller SA/ Vol ratio, with some cells far from the surface therefore diffusion alone cannot supply oxygen or glucose to their cells.
In Q01(c) candidates were asked to compare and contrast the gas exchange adaptations in an insect and in a fish. Again, almost all responses gained marks with the best noting similarities and differences. Similarities including: both have structures that increase surface area, both have a short diffusion distance and both have surfaces that allow oxygen and carbon dioxide to dissolve. And differences such as in insects gases delivered to / removed from cells directly but fish use circulation, fish have gills / lamellae / filaments whilst insects have tracheae/ tracheoles / spiracles and fish make use of counter current flow. Some responses did not include similarities or just listed properties of each but with no comparison.

Question 2

looked at gas exchange in plants.
In Q02(a) almost all candidates were able to correctly identify lenticels as allowing gases to enter woody plant stems.
In Q02(b) candidates were given a photograph showing stomata from part of the lower leaf surface of the plantain lily.

In Q02(b)(i) they were given the magnification of the photograph and asked to calculate the number of stomata per cm^2 on this part of the leaf surface. Only the best responses could calculate the number of stomata by using the magnification to calculate the area and then dividing the number of stomata by the area of the photograph.
In part Q02(b)(ii) candidates were asked to use their answer from Q02(b)(i) to calculate the estimated number of stomata found on the lower surface of a leaf that has a total area of 130 cm^2. Most were able to multiply their answer from Q02(b)(i) by 130 and thus gained the mark.
In Q02(b)(iii) most candidates were able to give a reason why the estimated number of stomata on the lower surface of the leaf may not be accurate.
In Q02(b)(iv) almost all responses could gain some marks for explaining why it is important for plants to be able to open and close their stomata. The best responses explained that during the day the stomata need to be open to allow carbon dioxide to enter for photosynthesis and that at night the stomata can close to reduce transpiration and maintain turgor.

Question 3

(a) In almost all candidates could give a function of blood clotting.
In Q03(b)(i) some candidates could correctly identify which factors are likely to lead to increased plaque formation and atherosclerosis.
In Q03(b)(ii) almost all candidates could correctly describe the conditions in which atherosclerosis develops.
Item Q03(c) gave information about deep vein thrombosis and the advice given to passengers on long-distance flights. Only the best responses could explain the advice given. The best responses explained that a DVT could prevent oxygenated blood from being supplied to cells thus reducing aerobic respiration. That flexing your leg muscles would cause contraction and increase venous return and prevent clot forming. If aspirin are taken the risk of bleeding is higher than the risk of DVT formation and that the side effects are worse than risk of DVT.

Question 4

Asked about classification systems. In Q04(a)(i) almost all candidates were able to identify Archaea as a domain**.** In Q04(a)(ii) almost all could also identify bacteria as not being in Eukaryota.

In Q04(a)(iii) almost all could identify the correct hierarchy for classification.
In Q04(b) most candidates gained full marks for describing the peer review process used by scientists to validate evidence for a new species.
In Q04(c) many candidates were able to explain the advantages and disadvantages of using zoos in the conservation of endangered animals. The best responses explained advantages such as new reproductive technologies can maximize the probability of reproductive success and prevent inbreeding and zoos can protect species from poaching so numbers can recover and prevent extinction. Disadvantages explained included zoos can lead to abnormal behaviours or adaptations to captivity which can prevent successful reintroduction. And that removing animals from their natural habitat reduces biodiversity and can affect food chains.

Question 5

Concerned haemoglobin and myoglobin. In Q05(a) candidates were required to compare and contrast the structures and roles of haemoglobin and myoglobin. Most candidates gained some credit with the best clearly stating the similariites and differences between the two molecules. The best responses include similarities such as both being globular proteins, both containing the haem group. They also included differences such as haemoglobin is found in red blood cells and myoglobin is found in muscle and myoglobin has a single peptide chain whilst haemoglobin has four peptide chains.
In Q05(b) information was provided about some species of mammal that are able to dive underwater for long periods of time. The information was a table showing the concentration of myoglobin in the muscle, the maximum duration of an underwater dive and the mean body mass of different mammal species. They were also given a second table describing the habitats for each of these species. Candidates were required to analyse the data to comment on the factors affecting dive time in these mammals. The responses to this level based item was encouraging with many scoring 3 or 4 marks. The best candidates used the information from both tables to identify the factors contributing to dive time. They chose suitable examples to illustrate the effect of each factor. They commented upon the effect of increased myoglobin on oxygen storage and the ability to respire aerobically for longer.

Question 6

Concerned water potential in plant cells. In Q06(a) candidates were given the equation $\psi = P + \pi$. They were asked to state what the terms P and π represent. Most responses scored at least one mark.
In Q06(b) details were given of an investigation to determine the osmotic potential and therefore water potential of plant epidermal cells. This was from core practical 6.
In Q06(b)(i) and Q06(b)(ii) almost all candidates could calculate the mean percentage plasmolysis in the salt concentration of 0.1 mol dm^{-3} and correctly plot a line graph of the data.
In Q06(b)(iii), however, some struggled to correctly read from their graph the concentration of salt solution in which incipient plasmolysis would occur.
In Q06(b)(iv) very few responses correctly used the concentration of salt solution at which 50% of cells are plasmolysed to determine the water potential of the epeideral cells. Finally in Q06(c) very few candidates could explain that at incipient plasmolysis the cell wall is not touching the cell membrane so turgor pressure (P) is 0 and osmotic potential of cell contents (π) = water potential of cell (ψ).

Question 7

Gave information about *Drosophila silvestris* and *Drosophila planitibia* two related species of fly. *Drosophila silvestris* is found only on Hawaii island and *Drosophila planitibia* is found only on Maui island. In Q07(a) most candidates were able to describe what is meant by the term niche.
In Q07(b) candidates were asked which groups do *Drosophila silvestris* and *Drosophila planitibia* belong in. Most could recognise that they would be in the same family, genus, order and phylum.
In Q07(c) candidates were told that when these two species of fly are crossed together, some of the offspring are sterile and some are fertile. The candidates then had to explain how the production of some sterile and some fertile offspring may cause a problem in classifying these flies. Most responses gained both marks by explaining that a species is defined as a group of organisms that interbreed to produce fertile offspring so some are same species and some are different species by this definition.
In Q07(d) most candidates were able to use the information in the question to explain how these two species evolved from a common ancestor. The best answers explained that this was an example of geographical isolation as some flies settled on Hawaii

Island some on Maui. That this prevented interbreeding so there was no exchange of alleles. The two populations then evolved differently, due to different selection pressures on each island favouring different mutations. This is an example of allopatric speciation. Weaker responses wrote that it could be allopatric or sympatric speciation.
Finally in Q07(e) most candiadtes were able to gain credit for describing what additional information can be used to help clarify the evolutionary relationship between these two species of fly.

Question 8

Was based on core practical 8. In Q08 candidates were given a diagram showing two types of bubble potometer. In Q08(a) some candidates were able to note that potometer A had a reservoir so the bubble could be reset on the scale.
In Q08(b) candidates were given a table showing the results of changing the fan speed on the rate of bubble movement in potometer B. Candidates were asked to explain the effect of changing fan speed on the rate of the air bubble movement. Most responses described the effect rather than explained it. Only the best candidates explained that increasing fan speed blows away saturated air from stomata so transpiration and water uptake increased as there was a steeper diffusion gradient.
In Q08(c)(i) some candidates were able to explain a variable that is difficult to control in this investigation. Suitable examples were temperature increasing the kinetic energy of the water molecules thus increasing transpiration or increased light intensity causing a change in stomatal aperture.
In Q08(c)(ii) candidates were asked to explain one factor that may reduce the accuracy of potometer B. Only the best candidates were able to explain a factor such as the lack of an airtight seal will slow air bubble movement and may stop transpiration and water uptake.
In Q08(d)(i) candidates were asked to use a formula to calculate the volume of water taken up in mm^3 min^{-1}. The examiners were pleased to note that most candidates gained credit with many scoring full marks. However, in Q08(d)(ii), few candidates could describe how the student could determine the rate of water uptake per cm^2 of leaf surface. Those that scored rarely described the method of determining the surface area of the leaf, such as drawing around the leaf on graph paper.
Finally in Q08(e) candidates were required to describe how the student could use potometer B to measure the effect of temperature on the rate of water uptake. About half of the responses gained some marks but answers were often vague and did not give sufficient detail to gain marks.

Summary

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.

- Write in detail and use correct and precise biological terminology.

- Carefully revise core practical work and methods.

- Remember to use the knowledge and skills acquired during practical work to help in indirect practical skills items.

- Understand the meaning of all terms given in the specification.

- 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.

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