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Examiners' Report
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GCE Biology B 8BI0 02

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Introduction

This was the second AS Paper 2 examination of the new linear specification. The new styles of AS papers place more emphasis on data analysis and interpretation, more questions in a practical context, an increased mathematical content and less scaffolding (resulting in fewer one or two mark questions). There are generally fewer mark points available for each question so that it is no longer possible to gain full marks for a question without giving a direct, correct answer.

There was a range in the quality of answers with some excellent, well thought through and detailed responses. Other answers did not include sufficient depth or detail or use the correct biological language so did not earn credit.

Candidates were able to analyse data about deforestation in Question 5(a), evaluate statements about deforestation in Question 5(c), to explain methods of electrophoresis in Question 6(b), and to devise an investigation in Question 9(c).

Some candidates struggled with mathematical content such as magnification in Question 2(b), comparison of rate in Question 3(c)(i) and percentage calculation in Question 8(a)(i).

On some items, notably Questions 1(b), 5(a) and 9(c), very few candidates gained full credit. Question 1(b) required an analysis of heart rates, Question 5(a) an explanation of what a graph shows and, as mentioned previously, Question 9(c) designing an investigation.

Question 1 (b)

This question required candidates to analyse the data in the ECG traces and comment upon the diagnosis of stress. Most responses earned 1 mark for noting an increase in heart rate and some gained a second for suggesting that the increase could be due to another factor such as smoking or diet. Very few candidates gained full marks.

The doctor diagnosed that the person was suffering from stress.

Analyse the data in both ECG traces to comment on this diagnosis.

(3)

In the first ^{ECG} ECG, the trace showed a heart rate of about ^{57bpm} 65 bpm, but in the second one, this had increased to over 90 bpm. This tachycardia could be caused by many things, ^{even though} however, elevated cortisol levels are a valid cause for a faster heart rate, the individual may have also reduced their level of fitness or developed multiple atheromas.



ResultsPlus Examiner Comments

This response scores 2 marks for noting an increase in heart rate and for suggesting that the increase may be due to level of fitness or atheroma.



ResultsPlus Examiner Tip

Candidates should ensure that they make three clear points if the question has 3 marks available.

The second ECG trace demonstrates that the ^{person's} heart is beating faster as it shows approximately 5 heart beats within 3 seconds, whereas the first ECG trace demonstrates 3 heart beats ~~for~~ within 3 seconds.



ResultsPlus Examiner Comments

This response only scores 1 mark for noting an increase in heart rate.

Question 1 (c)

This question required candidates to explain why the increased blood pressure associated with stress is a health risk. Many responses scored marks for mentioning damage to the endothelium, an inflammatory response. They also scored marks for the general effects of increased blood pressure on the body, such as an increased risk of heart disease or strokes. The strongest responses included specific references to arteries, including the formation of plaque, which leads to a narrowing of these arteries, reducing blood flow and thus further increasing blood pressure.

(c) Stress increases blood pressure, which can damage blood vessels.

Explain why stress is a health risk.

(4)

Stress causes an increase in blood pressure which can lead to damage of endothelial lining. This means causes an inflammatory response which leads to a build up of cholesterol, this in turn can lead to plaque formation. After that this will cause loss of elasticity for the arteries ~~but~~ which will increase risk of blood clotting. This can lead to damage to blood vessels and aneurysm.



ResultsPlus

Examiner Comments

This response scores all 4 marks for damage to endothelial lining, inflammatory response, plaque in the arteries and increased risk of blood clotting.



ResultsPlus

Examiner Tip

Always use specific biological terms such as plaque forming in arteries, as reference to blood vessels is too vague and does not earn credit for some mark points.

Question 2 (b)

This question required candidates to calculate the magnification of the contractile vacuole by measuring the diagram and using the actual diameter. Some measured the whole *Amoeba* and others found the conversion from μm to cm problematic.

(b) The actual diameter of the contractile vacuole shown in this diagram is $20\ \mu\text{m}$.

Calculate the magnification of this *Amoeba*.

$$20 \times 10^{-6} \times x = 1.5 \times 10^{-2}$$
$$x = \frac{1.5 \times 10^{-2}}{20 \times 10^{-6}}$$

(2)



ResultsPlus

Examiner Comments

This response scored 2 marks for the correct answer.



ResultsPlus

Examiner Tip

Although full marks are available for the correct answer alone, candidates are encouraged to show all their working.

$$M = \frac{I}{A}$$

Image size = 1.5 cm

$20\ \mu\text{m}$

$$M = \frac{1.5\ \text{cm}}{0.002\ \text{cm}} = 250$$

$$20 \div 1000 = 0.02\ \text{mm}$$
$$\div 10 = 0.002\ \text{cm}$$

Answer $\times 250$



ResultsPlus

Examiner Comments

This response scores 1 mark for correctly measuring the vacuole as 1.5 cm.

Question 2 (c) (ii)

Most candidates were able to gain marks for noting that as the concentration of the bathing solution increases, the rate at which the contractile vacuole empties decreases. Some also scored a second mark for explaining that this is due to less water entering the *Amoeba* by osmosis.

Analyse the data to explain the change in the rate at which the contractile vacuole emptied.

(2)

As the concentration of mineral ions increased, the ~~water~~ water potential of the solution became more negative, therefore less water would diffuse into the cell and into the contractile vacuole due to a lower concentration gradient. Thus the vacuole filled less quickly.



ResultsPlus Examiner Comments

This response scores 1 mark for as concentration of ions increases less water enters cell.



ResultsPlus Examiner Tip

The response does not comment on the effect of increasing concentration on the rate of emptying.

Data shows that as the concentration increases from 5-25 au the rate decreases from 14-2. Because at low mineral ion concentration the water potential is high and so osmosis is faster, and so rate of emptying is more



ResultsPlus Examiner Comments

This scores both marks for as concentration increases rate decreases and converse of second marking point as at low concentrations more / faster osmosis.

Question 3 (a) (i)

Almost all candidates could correctly calculate the ratio.

Question 3 (b) (ii)

This question required candidates to explain how water is transported in the xylem to the leaves. The stronger responses included an explanation of how water is lost by evaporation from the stomata, and how this leads to a water potential gradient across the leaf cells, causing a tension or pull in the xylem vessels. They also included an explanation of how columns of water are held together by the cohesive forces between the polar water molecules, and how these water columns adhere to the xylem vessel walls.

(ii) Explain how this water is transported in the xylem to the leaves.

(3)

Water is transported up the plant in the transpiration stream. Due to hydrogen bonds, as water molecules are polar, the molecules are attracted to each other (cohesion) so when one water molecule evaporates from the stomata of the leaves, the water column underneath will be put under tension as the hydrostatic pressure in the leaves will be less than in the roots, pulling the water molecules upwards.



ResultsPlus
Examiner Comments

This response scores 3 marks with credit for transpiration stream, hydrogen bonds and cohesion, and water evaporates from stomata.

Because of adhesion and cohesion the water molecules stick together and to the xylem vessel. As the ~~environment~~ water potential is lower in the leaves, water molecules in xylem moves into the leaves by osmosis.



ResultsPlus
Examiner Comments

This response scores 1 mark for water potential lower in leaves. It gains no credit for adhesion or cohesion as these are confused and the answer makes no reference to the polar nature of water or to hydrogen bonds.



ResultsPlus
Examiner Tip

Candidates must ensure that their answers use terminology correctly and contain sufficient detail to earn full credit.

Question 3 (c) (i)

Candidates could gain full marks for calculating the correct increase in the rate of water loss in wind.

(i) Calculate the increase in the rate of water loss caused by wind.

(2)

$$\text{rate in air} = 2.6 \text{ g} / 20 \text{ mins}$$

$$\text{rate in wind} = 5 \text{ g} / 20 \text{ mins}$$

$$\text{difference} = 5 - 2.6$$

$$2.4 \text{ per } 20 \text{ mins}$$

$$\frac{2.4}{20} \text{ per } 1 \text{ minute}$$

$$= 0.12 \text{ g}$$

Answer 0.12 g min⁻¹



ResultsPlus Examiner Comments

This response gains full marks for the correct change in rate.



ResultsPlus Examiner Tip

Even though full marks are available for the answer alone, this candidate clearly shows the working, this is good practice.

↑ in rate

caused
by

wind

$$= \frac{5 - 0}{20 - 0}$$

$$= 0.25 \text{ g min}^{-1}$$



ResultsPlus Examiner Comments

This response scores 1 mark for correctly calculating one of the rates.

Question 3 (c) (ii)

This question required candidates to explain how the student could modify this investigation to improve its validity. Marks were awarded for stating the variable that should be controlled and explaining how this control could be achieved. Some candidates did not relate the control to this investigation so suggested controlling temperature by using an incubator, or controlling humidity by covering with a plastic bag. Candidates need to give an answer that makes reference to the particular experimental context.

Explain how the student could modify this investigation to improve its validity.

(2)

- Temperature should be controlled by putting the whole apparatus in an incubator.
~~The surf~~
~~the leaf~~
- The surface area of the leaf should be controlled.
- Light intensity should be controlled by placing a ~~big~~ power saving light bulb.



ResultsPlus
Examiner Comments

This response scores 2 marks for controlling light intensity using a power saving bulb.

The student could carry out the investigation in a water bath to regulate the temperature of the plant. This will prevent ~~a differ~~ factors such as evaporation affecting the result. Furthermore, the student should regulate light intensity by removing all natural light and using a lamp at a constant distance from the plant.



ResultsPlus
Examiner Comments

This also scores 2 marks for regulate light intensity using a lamp at a constant distance.

Question 4 (a) (ii)

This question required candidates to calculate the percentage change in white blood cells by the end of the first month of chemotherapy. Most could do this and earned full credit.

- (ii) Calculate the percentage change in the white blood cell count by the end of the first month of chemotherapy.

(2)

$$12,000 \rightarrow 2500$$

$$12,000 - 2500 = 9500$$

$$\frac{9500}{12,000} = 0.7916 \times 100 = 79.16\% \text{ decrease}$$

Answer 79.2% decrease



ResultsPlus
Examiner Comments

This is the correct answer, it scores 2 marks.

$$\begin{array}{l} 0 - 12000 \\ 1 - 2500 \end{array}$$

$$\begin{array}{r} 12000 - 2500 \\ = 9500 \end{array}$$

$$\frac{9500}{12000} = 0.79 \times 100 = -79.16\%$$

Answer -79.16%



ResultsPlus
Examiner Comments

This response scores 1 mark for divide by 12 000 and x 100.



ResultsPlus
Examiner Tip

No credit was given for the answer as there was a rounding error, should be 79.17 if given to 2 decimal places.

Question 4 (b)

This question asked for an explanation of how two of the symptoms of pancytopenia could be treated. Some candidates wrote about treatments but did not relate these to a particular symptom. Only the most able candidates gained full marks.

Explain how two of the symptoms of pancytopenia could be treated.

(4)

red blood cells contain haemoglobin which carries oxygen around the body. less red blood cells means less oxygen is being transported round the body by haemoglobin. This can lead to symptoms such as weakness, dizziness or fainting as red blood cells not meeting energy requirements. These symptoms can be ~~treated~~^{treated} by other means such as nutrients to ensure it doesn't happen. White blood cells help get rid of infections in the body such as antibodies and pathogens. less white blood cells could lead to increase risk of infections. This can be treated with antibiotics or more proteins in the body to discharge the antigens and antibodies.



ResultsPlus
Examiner Comments

This response scores 2 marks for noting that infections can be treated with antibiotics.

* To combat the reduction of white blood cells, the patient could be given antibiotics and could be kept in a sterile environment.

* To combat the reduction of platelets, the patient could be given injections of thromboplastin so that their blood would still be able to clot.



ResultsPlus
Examiner Comments

This response scores 3 marks for antibiotics or sterile environment as a treatment and thromboplastin as a clotting factor to enable blood to clot.



ResultsPlus
Examiner Tip

To score full marks candidates should write two symptoms and two corresponding treatments.

Question 5 (a)

This question asked candidates to analyse the data in the graph to explain how the protection of land from deforestation affects the percentage of species conserved. Few candidates gained more than 2 marks. Most scored marks for noting the increase in species conserved as more land is protected. Most also linked this increase to the protection of the animals' habitat or food source. A small number of candidates mentioned that when no land is protected some species still exist; with a smaller number explaining that this is because they do not directly rely on trees so may live in the soil or water.

(a) Analyse the data in the graph to explain how protection of land affects the percentage of species conserved.

(4)

AS you increase the percentage of land protected from deforestation, the percentage of species conserved also increases. By protecting land of deforestation this will ensure that species are conserved, as some species occupy a niche on trees & use it as a home as well as using it as a food source. If not protected this could cause a selection pressure of a loss of food. Since protected this will allow the percentage of species conserved to increase. The number of species conserved steps increasing at 90%.



ResultsPlus
Examiner Comments

This response scores 2 for increased land = more species, and trees as food source.

Protection of land creates there to be more habitats for species. As percentage of land protected increases, the percentage of species conserved increases. More species are conserved which will result in more genetic variation. At a 0% of land protected from deforestation there was only 10% of species conserved. At 100% of land protected there is a 100% of species conserved as they have their habitat and resources that they require need to survive and reproduce.



ResultsPlus

Examiner Comments

This response scores 3 marks for increasing land also increases species, more habitats protected and at 0% land protected still 10% of species conserved.

Question 5 (b)

This question required candidates to describe how scientists could collect the data needed for this formula in order to calculate biodiversity. Candidates needed to clearly state that they should determine the number of organisms of a particular species, and that they also need to add all of these together to determine the total number of organisms of all species. The third mark was for describing a method that could be used to sample the species. Only a few candidates gained all three marks.

(b) The number of species in a forest is one factor that affects biodiversity.

Some scientists use the following formula to calculate biodiversity.

$$D = \frac{N(N-1)}{\sum n(n-1)}$$

Describe how scientists could collect the data needed for this formula in order to calculate biodiversity.

(3)

Scientists should record the number of individuals of each different species and put their results in a table. This can be done

by using a quadrat to measure the number of organisms in a sample size, or by counting the number of species and individuals of ~~that~~ that species in a set area.



ResultsPlus

Examiner Comments

This response scores 2 marks, one for use of a quadrat to sample species and the second for counting the number of individuals of each different species.

They can calculate the number of a type of species living in an area. They can also take the number of different species living in an area.

N = number of one species

n = number of all species.



ResultsPlus

Examiner Comments

This scores 1 mark for 'number of a type of species' as total number of one species.

Question 5 (c)

This question required candidates to evaluate the statement that all forests should be protected from deforestation. The strongest responses considered the reasons against deforestation and explained them, such as the conservation of habitats to maintain biodiversity, the role of rainforests in absorbing carbon dioxide to mitigate the effects of increased carbon dioxide release, the role of forests in providing indigenous peoples with food, and the attraction of forests for tourists or for recreational use. They also pointed out the reasons for deforestation as the population expands, providing timber/land for housing or agriculture and the economic resources required in developing countries.

* (c) Some scientists state that 'all forests should be protected from deforestation.'

Evaluate this statement.

pros, cons

timber - wood
future

(6)

Some scientists believe that 'all forests should be protected from deforestation' as this will help maintain biodiversity and will prevent the loss of habitats. In addition, this will also prevent extinction of certain species which will allow us to use the forests for economic reasons. For example forests are "laboratories" and so studying species can help create new medicines and drugs to help people in the future. In addition there are aesthetic reasons why forests should be protected. For example the beauty and colour of forests bring happiness to many people. In addition if deforestation were to happen this would cause ecological problems as only a small portion of certain species will be clustered in one area (eg. tropics) which cause inbreeding and limit the gene pool. On the other hand perhaps all forests shouldn't be saved as land is needed for agriculture and for growing crops, ~~which~~ ^{and so without} crops could cause famine in LEDCs. In addition wood from trees is

needed for timber to make houses and infrastructure.

However for the reasons I have highlighted it is important to protect forests as not only does this prevent extinction but also protects forest people, for example the Amazonian people in the Amazon rainforest.

(Total for Question 5 = 13 marks)



ResultsPlus

Examiner Comments

This response scores 6 marks as it contains detailed points both against and for deforestation. It also attempts to reach a conclusion balancing for and against.

The statement is valid as it would increase biodiversity. This is valuable as it would conserve potentially endangered species that may be of benefit to humans. ~~Protecting a~~ Furthermore, the protection of forests should be supported as they provide a 'carbon sink', ~~absorbing~~ reducing levels of the harmful greenhouse gas CO_2 in the atmosphere. ~~the~~

The statement, however, is ~~very~~ impractical due to the obvious benefits that deforestation provides. For example, trees provide us with wood and medicine. Furthermore, the statement fails to accommodate people in agriculture such as farmers, whose livelihood may be affected by ~~extracting~~ ~~forests~~ expanding forests and the increase in animals that may harm crops.



ResultsPlus
Examiner Comments

This response scores 5 marks as it has 3 statements for deforestation and 2 statements against deforestation.



ResultsPlus
Examiner Tip

The full six marks were not given as a clear conclusion is not evident.

Question 6 (a)

This question asks for an explanation as to how the insects evolved from a common ancestor into three distinct species. The strongest responses included a reference to mutations that brought about a variation in mating calls, meaning only some females would be attracted to, or respond to, the changed call. This prevents interbreeding leading to reproductive isolation; an example of sympatric speciation. Less able candidates wrote about geographic isolation and allopatric speciation.

(a) Explain how the insects evolved from a common ancestor into three distinct species.

(4)

All insects may have been through sympatric speciation. They are in the same area but they have evolved into different species. This may have been caused by a ~~change in~~ mutation at one point which caused the mating call to be different. This will have caused mechanical isolation leading to reproductive isolation. This means the insects could not produce fertile offspring and therefore they became speciated.



ResultsPlus

Examiner Comments

This response scores 4 marks. It makes reference to sympatric speciation and to mutation producing different mating calls resulting in reproductive isolation.

Insects have evolved from a common ancestor through sympatric speciation. This is as 2 or more populations have been isolated reproductively in the same location. This can also be due to behavioural isolation as the calls for each different species is different from each other as shown in the sonogram, of which is a form of reproductive isolation.



ResultsPlus
Examiner Comments

This item scores 3 marks. It refers to sympatric speciation, reproductive isolation and mating calls being different.

Question 6 (b)

This question required candidates to explain how gel electrophoresis could be used to identify which species is most closely related to the common ancestor.

The strongest responses included details of how restriction enzymes are used to cut DNA into fragments. These fragments are put into wells in agar and a potential difference is applied across the plate, which causes different sized or charged fragments to move different distances. The banding pattern can be revealed using a dye or fluorescence. The species that has the most similar pattern of bands is closest to the common ancestor.

(b) Explain how gel electrophoresis could be used to identify which species is most closely related to the common ancestor.

(4)

A sample of DNA can be taken from the species which is amplified through PCR then placed in wells at the negative end in a buffer solution after being cut by restriction enzymes at specific places to different lengths. The lighter fragments will travel faster towards the positive end (DNA has negative phosphate group).

The DNA can be seen under UV light. The fragments will form bands at different distances due to their mass. The pattern can be compared to other species to see if there are similarities. The more similarities there are, the more closely they are related.

(Total for Question 6 = 8 marks)



ResultsPlus
Examiner Comments

This response scores 4 marks for use of restriction enzyme cutting DNA into different lengths, that lighter fragments travel faster and that UV light is used to reveal pattern, and reference to a similar pattern to the common ancestor.

No credit for using agar as no reference to agar.

Gel electrophoresis is when they take a sample of their DNA and put it into a type of Agar. They add a fluorescent dye to it so that they can see. They use an electric current to pull the sample down the Gel isolating segments of its DNA. Using Ultraviolet light (UV) they look at the bands. The ones with DNA in the same places as its ancestor is the closely related one.

(Total for Question 6 = 8 marks)



ResultsPlus
Examiner Comments

This example scores 2 marks for reference to agar and current to separate the DNA, and for reference to using UV light.

No credit for compare with the common ancestor, as no reference to pattern or bands.

Question 7 (a) (i)

Candidates were able to gain credit for providing the reason why thromboplastin and calcium ions were added to the plasma sample; simply stating that they catalyse the conversion of prothrombin into thrombin.

Question 7 (a) (ii)

This question required candidates to explain why the plasma from the farmer's dog had a longer clotting time. Most candidates scored some marks, with the most able candidates earning all three marks for explaining that the plasma has low vitamin K, so less prothrombin can be converted to thrombin and thus less fibrinogen can be converted into fibrin.

- (ii) The clotting time for the plasma from the farmer's dog was 73 seconds. The clotting time for the plasma from the healthy dog was 12 seconds.

Explain the difference in these clotting times.

(3)

Due to lack of activity of vitamin K caused by the anticoagulant, and therefore the reduced synthesis of prothrombin, clotting took longer because prothrombin is needed to form thrombin, which is essential in converting soluble fibrinogen into insoluble fibrin, which forms a mesh which traps blood cells and platelets, forming a blood clot.



ResultsPlus
Examiner Comments

This example scores all 3 marks. It includes less vitamin K, so less prothrombin to thrombin and the idea of less fibrinogen to fibrin.

(3)
The farmer's dog would have ~~ingested~~ ^{ingested} some of the anticoagulant bait, which would reduce the dog's blood's ability to form thrombin from prothrombin, and therefore inhibit its ability to catalyse the formation of fibrin, which is insoluble and ^{forms a mesh which} traps a bundle of blood cells, forming a clot (from fibrinogen), and therefore would have a significantly longer clotting time (61 seconds longer) than in the healthy dog.



ResultsPlus

Examiner Comments

This example scores 2 marks for less thrombin from prothrombin and less fibrin from fibrinogen. There is no reference to vitamin K.

Question 7 (b)

This question asked for one way that a vet could reduce the symptoms of excessive bleeding. Most candidates correctly answered with vitamin K, prothrombin, thrombin etc.

- (b) Give one way in which the vet could treat the farmer's dog to reduce the symptom of excessive bleeding in the gums.

(1)
Give
increase the amount of vitamin K ~~to~~
supplements.



ResultsPlus

Examiner Comments

This response gains the mark.

Question 7 (c)

This question required candidates to explain the effect of blood collecting in the lower part of the lungs of the dog. Many candidates correctly explained that this would reduce the surface area, thus reducing gas exchange and resulting in less aerobic respiration and less energy for the dog.

- (c) The vet noticed that blood had collected in the lower part of the lungs of the farmer's dog.

Explain how this would affect the farmer's dog.

(2)

Less surface area in the farmer's dog's lungs, making it much more difficult for respiration to occur.



ResultsPlus Examiner Comments

This response earns 2 marks for reference to less surface area and thus less respiration.



ResultsPlus Examiner Tip

Answers do not need to be long or verbose to score full credit.

It would reduce the amount of gas exchange taking place between the lungs as it would fill the alveoli with blood, preventing them from filling with air, thus reducing the lung capacity of the dog and therefore its capacity for gas exchange. This would hamper its aerobic capacity.

(Total for Question 7 = 7 marks)



ResultsPlus Examiner Comments

This scores 1 mark for reduction in gas exchange.

Question 8 (a) (i)

This question required candidates to explain why the production of tissue fluid is vital for the cells in the human body. Some candidates were able to explain that cells require oxygen or glucose to be supplied for respiration. Credit was also given for mentioning the removal of a named waste product such as urea or carbon dioxide.

8 The production of tissue fluid is vital for cells in the human body.

(a) (i) Explain why the production of tissue fluid is vital for cells in the human body.

(2)

If allows minerals and O_2
in the blood fluid to be absorbed by cells
to respire.



ResultsPlus
Examiner Comments

This example scores 2 marks for supplying oxygen for respiration.

Question 8 (a) (ii)

This question required a calculation of the mass of tissue fluid in grams that would be found in a person of body mass 80kg. Many responses scored full marks but whilst almost all candidates could calculate 12.8%, some had difficulties with expressing their answer in g.

(ii) Tissue fluid makes up 16% of the mass of a human body.

Calculate the mass of tissue fluid, in grams, that would be found in a person with a mass of 80 kg.

(2)

$$80,000 \times 0.01 = 800 (= 1\%)$$
$$800 \times 16 = 12,800$$

12,800
Answer 12,800 g



ResultsPlus
Examiner Comments

This example scores full marks for 12 800.

~~80~~
 $\frac{16}{100} \times 80 = 12.8 \text{ KJ of tissue fluid.}$

\downarrow
 $12.8 \div 1000$

$= 0.0128 \text{ g}$
of tissue
fluid.

Answer 0.0128 g



ResultsPlus
Examiner Comments

This example scores 1 mark for 12.8.

Question 8 (b) (ii)

This question required candidates to compare and contrast transport in a vein with transport in a lymph gland. Compare and contrast means that candidates' answers must contain at least one similarity and at least one difference. The majority of responses that earned credit achieved only one mark.

(ii) Compare and contrast the transport of fluid in a vein with its transport in a lymph vessel.

(2)

They both have valves to prevent back flow and operate under low pressures, although veins carry blood to the heart and lymph vessels carry lymph to the subclavian vein.



ResultsPlus Examiner Comments

This response scores 2 marks for one similarity – both have valves, and one difference – veins return fluid to heart and lymph to subclavian/ neck.



ResultsPlus Examiner Tip

The command words 'compare and contrast' mean that the answer should include at least one similarity and at least one difference.

the transport of fluid in veins is faster and more fluid can be transported as they are smaller and more narrow than lymph vessels.



ResultsPlus Examiner Comments

This example scores 1 mark for one difference.

Question 8 (d)

This question asked candidates to analyse and criticise the claim that LF could be eradicated by the drug treatment. The best responses included a reference to the large reduction in the number of cases of LF, and that 500 represents a large sample for a drug trial. However, there was an increase in the numbers in year 5 and only one area was tested. Other reasons given for the reduction in cases were credited, such as a reduction in mosquito numbers or an increase in the use of mosquito nets. Most candidates scored at least 2 marks.

The scientists claimed that LF could be eradicated by using this drug treatment.

Analyse the data to criticise this claim.

(4)

The data ~~shows~~ shows that signs of LF are greatly reduced in many people ~~in~~ in the years after the drug began to be used. Every year, a steady decline in LF symptoms occurred. In year 5 however, the number of people showing signs of LF increased from that in year 4. This suggests that there may be other factors affecting LF in people that cannot be controlled by the drug. Therefore the drug can be used to greatly decrease the signs of LF in many people, however it cannot be concluded that it can be eradicated by the drug, as evidence shows that some factors cannot be treated by it.

(Total for Question 8 = 12 marks)



ResultsPlus
Examiner Comments

This scores 2 marks for numbers greatly reduced and for noting that in year 5 numbers increased.

- In year 5 the percentage showing signs increased from 16% to 17.5% from the year before, showing the drug may have limited impact.
- They are caused by mosquito bites which encircling are attempting to reduce external to this experiment (due to malaria).
- The sample size of 500 is modest compared to the 120 million affected and selected randomly so may be disproportionately young / old / male / female etc.
- none of this is shown in the data.
- If all the people in an area are given a drug and it doesn't eradicate it for everyone then it will be difficult to eradicate.



ResultsPlus
Examiner Comments

This example only scores 1 mark for noting an increase in cases in year 5.

Question 9 (a)

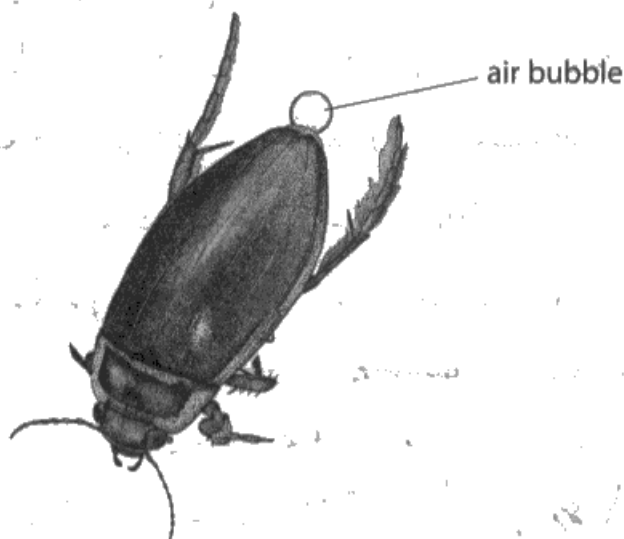
This question asked candidates to state how the oxygen in the air bubble reaches the cells in the beetle. To score the mark, the responses needed to contain the mechanism of movement i.e. diffusion, and the route from spiracles to trachea or tracheoles. Many responses failed to mention diffusion so were not credited.

- 9 The insect *Dytiscus marginalis* is a beetle that can dive underwater to feed.

Before diving underwater, the beetle traps an air bubble underneath its wings.

The air bubble is connected to its spiracles.

The diagram shows a beetle with an air bubble attached to its body.



- (a) State how the oxygen in the air bubble reaches the cells in the beetle.

(1)

Enters the trachea through spiracles and diffuses into cells.



ResultsPlus

Examiner Comments

This example scores the mark for reference to entering through spiracles into the trachea by diffusion.



ResultsPlus


Examiner Tip

Sometimes, as in this case, three aspects are needed to score 1 mark.

Question 9 (b)

This question required candidates to explain how, when the beetle is underwater, gas movements will affect the size of the bubble and thus the time the beetle can stay underwater.

Many candidates struggled to explain the interaction between the factors and gained only 1 or 2 marks. Often they suggested that oxygen is used by the beetle for respiration or that initially oxygen diffuses out of the bubble and into the water down a concentration gradient. In both cases they often correctly observed that the bubble would decrease in size.

(b) When the beetle is underwater, gases can enter or leave the air bubble. 

These gas movements affect the size of the bubble.

When the beetle first dives, the concentration of oxygen is higher in the bubble than in the water.

Explain why these facts will affect the time the beetle can stay underwater.

(3)

Oxygen moves by diffusion down the concentration gradient.

This decreases the size of the bubble. This means

that there is less oxygen for the beetle. Less oxygen for cellular respiration. As a result, the beetle must leave the water

for more oxygen. This decreases the amount of time the beetle can stay underwater.

Steeper concentration gradient = high diffusion rate

Gradient between the beetle and the bubble also decreases.



ResultsPlus
Examiner Comments

This response scores 3 marks for oxygen diffuses out of bubble, the bubble becomes smaller and oxygen is used for respiration.

Because the oxygen overtime will move out of the air bubble into the water due to diffusion. This means eventually the level of oxygen will balance and be the same inside the bubble as outside and therefore the beetle will not be able to respire.



ResultsPlus
Examiner Comments

This example scores 2 marks for oxygen diffuses out of bubble and oxygen required for respiration.

Question 9 (c)

The final question on the paper required candidates to design an investigation to show the effects of water temperature on the time a beetle can stay underwater. Most candidates were able to score some credit on this question but few scored high marks.

Some candidates suggested an inappropriate range of temperatures or did not specify how many different temperatures they should use. Often responses referred to repeating but it was not always clear what they intended to repeat.

Candidates that gave the clearest responses wrote about using beetles of the same species, in 5 different temperatures such as 5, 10, 15, 20 and 25°C, which would neither freeze nor overheat the beetle. They mentioned controlling the depth of water and ensuring it had the same oxygen content. They included measuring how long in seconds each beetle stayed underwater and using several beetles to calculate a mean at each temperature.

(c) Warm weather increases the temperature of the water.

This affects the time a beetle can stay underwater.

Devise an investigation to show the effect of water temperature on the time a beetle can stay underwater.

(5)

There will be 5 conditions. ~~Over 2000~~ ~~1000~~
~~2000~~ ~~1000~~ 1 → 5°C 2 → 10°C 3 → 15°C 4 → 20

$5 \rightarrow 25^{\circ}\text{C}$ $6 \rightarrow 30^{\circ}\text{C}$. A beetle will be placed in the water bath ~~up~~ and the time it takes underwater will be measured with a stopwatch. The independent variable is the temperature of the water bath. The dependent variable is the time taken for the beetle to stay underwater (^{seconds}). The feed will be placed at the bottom of each water bath. The conditions will be repeated 3 times with 3 different beetles (of the same species) and a mean will be calculated. These values can be plotted on a line graph to show how the temperature affects the time. As the temperature increases, the kinetic energy of the oxygen molecules increases meaning more successful collisions and faster diffusion. The results should show a decrease in time as temperature increases.



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Examiner Comments

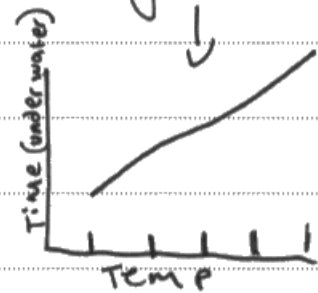
This example scores 4 marks. It gains credit for choosing at least 5 temperatures with a sensible range. It measures the time in seconds that the beetle stays underwater. It is repeated at each temperature and it uses the same species of beetle.



ResultsPlus
Examiner Tip

It would gain full marks if it suggested an appropriate control variable such as depth or oxygen content of water.

Construct five tanks each with beetle food in and containing standard pond water at increasing temperatures, being sure to have one at a regular temperature to compare the results to. Place a beetle in each tank and take three timings for each temperature, starting as the beetle is submerged and ending when the beetle emerges. After recording the results in a table calculate the mean time spent underwater for each condition and produce a graph. I would predict a positive correlation between temperature and time spent underwater because the water molecules would have more kinetic energy making it easier for the beetle to move underwater.



ResultsPlus

Examiner Comments

This example scores 2 marks for using same pond water and for three timings for each temperature.

No credit for dependent variable as no reference to minutes or seconds. No credit for independent variable as range or number of temperatures not given.

Paper Summary

Based on their performance on the paper, candidates are advised to:

- work on improving their analysis and experimental design skills. Candidates need to be able to write in sufficient depth and detail using appropriate and precise terms so that they can earn full credit for their biological knowledge and understanding
- remember to use the correct biological terminology
- read the questions very carefully.

Grade Boundaries

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