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June 2018

GCE Biology B 8BI0 02

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Introduction

The AS paper 2 allowed candidates the opportunity to show their knowledge and understanding of the topics they have covered during the course. It also enabaled 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 mean mark for this paper showed a slight improvement on the equivalent paper from last year.

Question 1

Question 1 required candidates to explain how the gas exchange system of an insect is adapted for efficient update of oxygen. The very best candidates were able to explain that the insect absorbs oxygen through spiracles into trachea and then into tracheoles. That the oxygen diffuses from the tracheols directly into the respiring cells. The tracheoles also provide a large surface area for diffusion and are thin walled so that the diffusion distance is short. Other credit worthy points were that insects have air sacs to provide a reservoir or store of oxygen and abdominal contractions enable ventilation movements to take place.

This response scored 3 of the possible 4 marks available. It gained credit for reference to oxygen passing from spiracles to trachea and into tracheoles. It also stated that tracheoles provide a high surface area. The response gains a third mark for explaining that the insect has air sacs that act as reservoirs for oxygen.

1 The photograph shows an insect.



- tracheoles
- spiracles
- sphincters

Explain how the gas exchange system of an insect is adapted for the efficient uptake of oxygen.

(4)

An insect cant has spiracles along its thorax which allow oxygen in and carbon dioxide out; these are controlled by sphincters which close in periods of inactivity to reduce the amount of water vapour loss. Trachae is made of chitin therefore impermeable to gases which then branch off into tracheoles. These lead to a high surface area which allow more oxygen to be taken in. At the ends of the lengths of the tracheoles there is water (at times of high inactivity), the water enters the surrounding cells via osmosis to accomodate for more room for oxygen. Sphincters open ~~close~~ when a stimulus such as high concentration of carbon dioxide occurs, preventing water loss therefore maintaining a favourable environment for gas exchange. The trachae prevent the gas exchange system from collapsing. The tracheoles are thin therefore provides a short diffusion distance. Air sacs in the system act as air reservoirs for more oxygen.

ResultsPlus
Examiner Comments

The reponse also gives other details about tracheoles but these are alternatives of the same marking point.

ResultsPlus
Examiner Tip

To score full marks candidates need to comment on other structures not just tracheoles.

This response scores 2 marks.

1 The photograph shows an insect.



Explain how the gas exchange system of an insect is adapted for the efficient uptake of oxygen.

(4)

Air enters the insects body through the spiracles and ~~moves~~ enters to the trachea. From the trachea the air moves through to the small tracheoles. The tracheoles are fine tubes which allow the quick diffusion of gases to the body's cells.

ResultsPlus
Examiner Comments

This response scores 2 marks for reference to air moving through spiracles, trachea and then tracheoles and for reference to diffusion.

ResultsPlus
Examiner Tip

The description of the traceoles as fine tubes was not enough for an explanation that thin walled tracheoles provide a short diffusion distance.

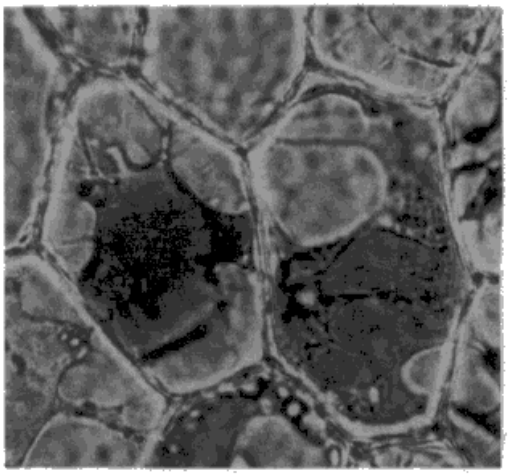
Question 2 (b) (i)

Question 2 provided students with data from an experiment to determine the osmotic potential of onion cells by using the method of incipient plamaolysis. Candidates were told that the point of incipient plamolysis is when 50% of the cells are plamolysed.

In this item candidates needed to recognise the point of 50% plasmolysis and read the value in mol dm $^{-3}$ and then use this value to determine the equivalent osmotic potential in kPa from the table. Some candidates failed to get full credit as they failed to include the minus in front of their osmotic potential.

This response scores full credit.

(b) If plant cells are placed in a solution with a lower water potential, the cell membranes will shrink away from the cell wall. The cells are described as plasmolysed.



The point at which 50% of the cells are plasmolysed can be used to estimate the osmotic potential of the cells.

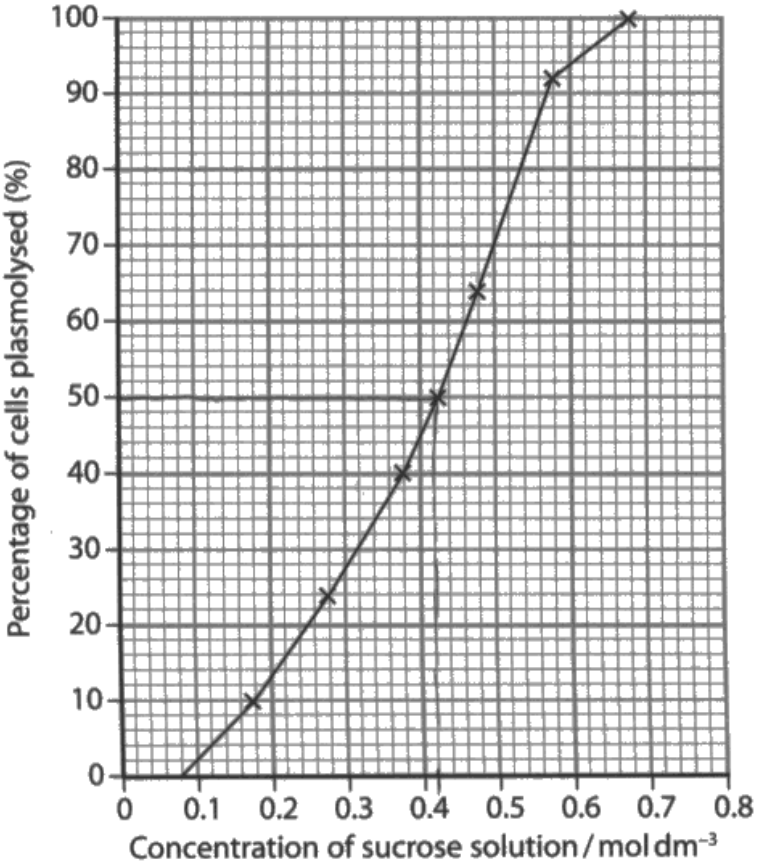
An experiment was carried out to determine the osmotic potential of onion cells.

Onion cells were placed in a range of sucrose concentrations and left for 10 minutes at 25 °C.

A sample of 50 cells was observed for each solution.

The percentage of plasmolysed cells was recorded.

The results are shown in the graph.



The table shows the osmotic potential of a range of sucrose solutions.

Concentration of sucrose solution / mol dm^{-3}	Osmotic potential / kPa
0.30	–860
0.35	–970
0.40	–1120
0.45	–1280
0.50	–1450
0.60	–1800

(i) Analyse the data in the graph and in the table to explain how the osmotic potential of these onion cells could be determined.

(3)

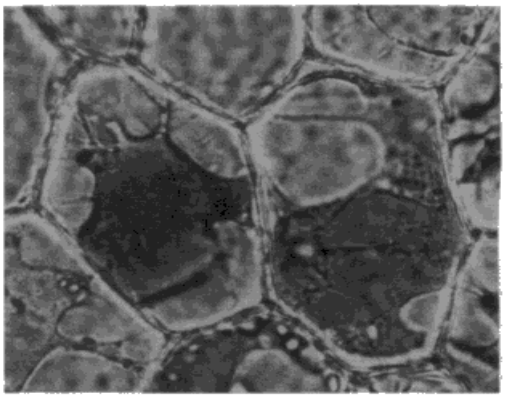
From looking at the graph osmotic potential was reached at around 0.425 mol dm^{-3}. The table above shows that at 0.40 mol dm^{-3} the osmotic potential was -1120 and at 0.45 mol dm^{-3} it was -1280. So the osmotic potential will be $-1120 > \pi > -1280$ so around 1200 kPa

ResultsPlus
Examiner Comments

It gains marks for for identifying that the osmotic potential of the cell is equivalent to the 50% plasmolysis and has a value from the graph of 0.425. They then use this value to find the corresponding osmotoc potential lies between -1120 and -1280 kPa.

This response also scores all 3 marks.

(b) If plant cells are placed in a solution with a lower water potential, the cell membranes will shrink away from the cell wall. The cells are described as plasmolysed.



The point at which 50% of the cells are plasmolysed can be used to estimate the osmotic potential of the cells.

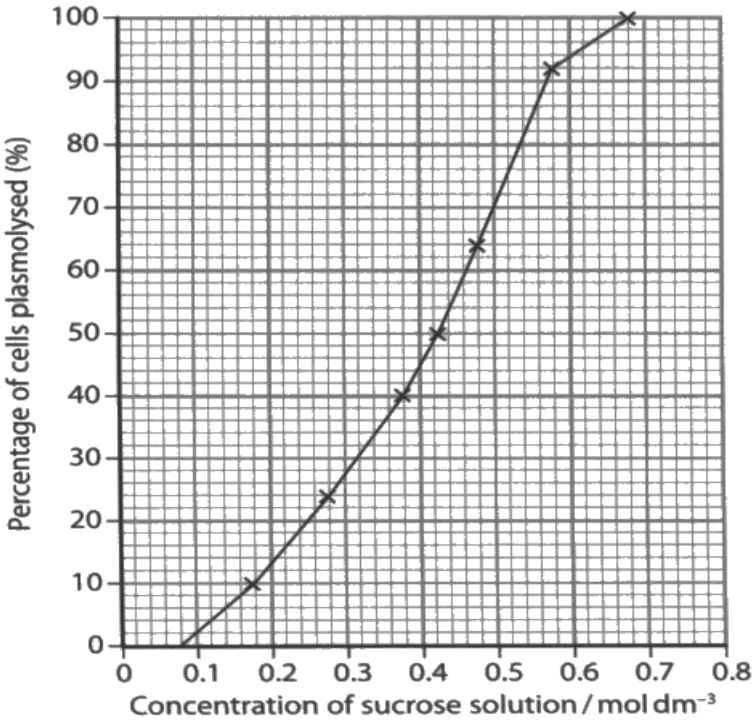
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0.45	–1280
0.50	–1450
0.60	–1800

(i) Analyse the data in the graph and in the table to explain how the osmotic potential of these onion cells could be determined.

(3)

When 50% of cells are plasmolysed it is a concentration of 0.425 mol dm^{-3} of Sucrose. This is incipient plasmolysis and with has an osmotic potential of just over -1120kPa. As Sucrose concentration increases there is almost a direct relationship to % plasmolysed cells, as well as the osmotic potential decreasing around

ResultsPlus
Examiner Comments

It gains marks for correct reference to using the value for 50% of cells plasmolysed from the graph which corresponds to a concentration of 0.425 mol dm^{-3} and using this value to read off the value of above -1120 kPa.

Question 2 (b) (ii)

In question 2(b)(ii) candidates were required to explain why the plant tissues were left in sucrose solution for 10 minutes before the cells were observed. Most reponses correctly explained that time is needed to allow the cells to undergo osmosis and for the water to move by osmosis out of the cells. Fewer candidates gained the second mark for explaining that this would ensure an acurate value of the osmotic potential.

Question 3 (a)

In Question 3(a) almost all candidates could correctly calculate the cardiac output for the heart with a stroke volume 120 cm^3 and heart rate of 160 beats min^{-1}.

Question 3 (b)

In question 3(b) candidates needed to analyse the data to explain the relationship between heart rate and cardiac output. Most reponses explained that as heart rate increases so does cardiac output. Far fewer candidates explained that stroke volume increases from 110 cm^3 to 120 cm^3 then stayed constant at this volume.

This responses scores both marks.

(b) Analyse the data to explain the relationship between heart rate and cardiac output.

(2)

As the heart rate increases for beats min^{-1} the cardiac output also increases. This is shown because when the heart rate is 60 beats min^{-1} the cardiac output is 6·6 dm^3 min^{-1}, Whereas when the ~~17~~ heart rate is 175 beats min^{-1} the Cardiac Out put is 21·0 even though the Stroke Volume stays the same after 100 beats min^{-1} the cardiac Output Still Increases.

ResultsPlus
Examiner Comments

It gains marks for explaining the increase in cardiac output with increased heart rate. It also gains the second mark for explaining that the stroke volume stays the same after 100 beats per minute.

ResultsPlus
Examiner Tip

To gain full marks on a 2 mark question candidates ust make two clear points.

This response also scores both marks.

(b) Analyse the data to explain the relationship between heart rate and cardiac output.

(2)

As the heart rate increases the stroke volume increases from 110 to 120 cm^3 and stays here. However the cardiac output ~~increases~~ keeps increasing.

as the heart rate increases the cardiac output increases.

ResultsPlus
Examiner Comments

The first mark for explaining that as the heart rate increases the stroke volume increases from 100 to 120 cm^3 and stays here. The second mark for writing that as the heart rate increases the cardiac output increases.

Question 3 (c) (i)

Question 3(c)(i) proved challenging for many candiadtes with few scoring above 1 mark. Most responses could explain the route of the nerve impulses from SAN to AVN and then onto the bundle of His and Purkyne fibres. Only the best reponses refered to an increase in frequency of impulses arriving at the SAN and very few explained that more of the venticle would contract.

This response is typical of most of the candidate responses to this item.

(c) (i) Explain how electrical events during the cardiac cycle can lead to an increase in stroke volume.

(3)

In the atria it is the sinoatrial node which depolarises cells around it meaning a electrical impurse is generated, this travels into the atrioventricular node in the septum which passes it down to the bundle of His and the purkyne tissue meaning the ventricle will contract (systole). This increases stroke volume as it ensures the ventricle can contract passing blood into the arteries (i.e. aorta) so more blood can be pumped out per minute.

ResultsPlus
Examiner Comments

It gains 1 mark for the route that the impulses take during the cardiac cyle. No reference to increase in frequency of impulses arriving at the SAN and no reference to more of the ventricles contracting.

ResultsPlus
Examiner Tip

As in other questions candidates need to ensure that to score 3 marks they must make 3 distinct and clear points.

Question 3 (c) (ii)

Item 3(c)(ii) required candidates to explain why athletes who train for long distance races often have low resting heart rates. Full marks were obtained by explaining that training increases the thickness of the heart muscle or walls of the venticles. This would lead to an increased stroke volume so that the same cardiac output could be achieved with fewer beats. Thus at rest sufficient glucose and oxygen can be delivered to allow respiration in cells.

This response scores 2 marks.

(ii) Explain why Olympic athletes who train for long distance events often have low resting heart rates.

(4)

Olympic athletes heart will go through what is called hypertrophy which means the cardiac muscles surrounding the heart will be thicker and stronger. This means the heart is able to pump more blood in one contraction compared to the normal average of meeting the bodies demand. The heart will therefore not need to contract as much because the body is already used to the amount of oxygen that is getting moved around the body. the blood is also more rich in oxygen due to an increase in heamoglobin and ~~A~~ the athlete having more alveoli.

ResultsPlus
Examiner Comments

It gains 1 mark for explaining that the athelete's heart as having hypertrophy which is equivalent to more heart muscle. It also gains a second mark for more blood in one contraction which is a description of a larger stroke volume.

ResultsPlus
Examiner Tip

To gain full marks the candidates needed to include reference to the same cardiac output therefore delivering sufficient oxygen and glucose to the cells with fewer beats.

This response also scores 2 marks.

(ii) Explain why Olympic athletes who train for long distance events often have low resting heart rates.

(4)

They will have increased their stroke volume, as a larger constant supply of O_2 is needed and so their heart muscles would be stronger. That it is able to pump more blood and to reach the same cardiac output when resting will require less beats.

Hr ÷ Stroke volume = Cardiac output

As stroke volume ↑ Hr ↓

to equal same output.

ResultsPlus
Examiner Comments

It gains credit for increased stroke volume and for reference to maintaining the same cardiac output with less meaning fewer beats.

ResultsPlus
Examiner Tip

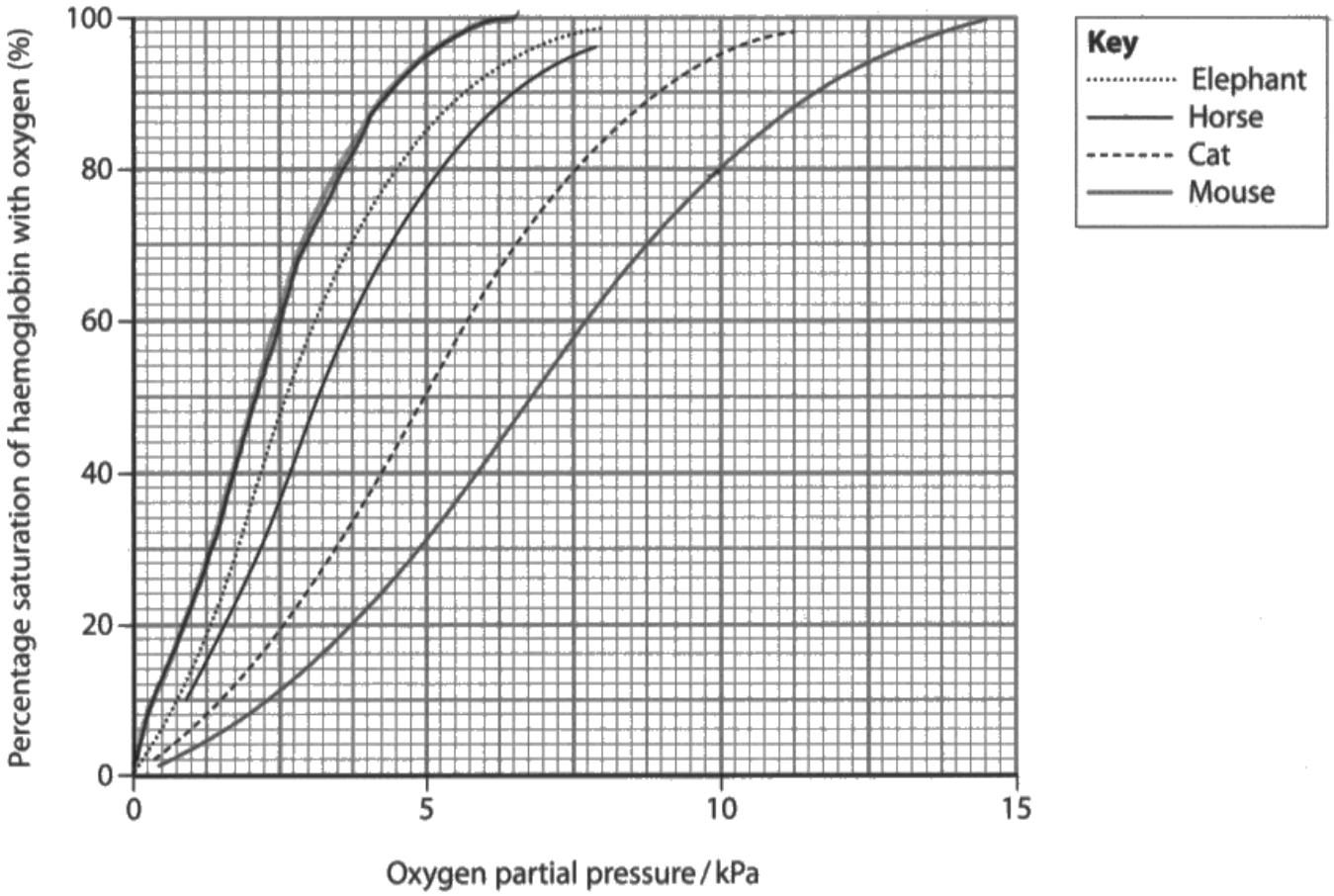
The response does not refer to increase in heart muscle or supply of sufficient oxygen or glucose to cells to allow respiration.

Question 4 (a)

Question 4(a) asked candidates to explain the shape of the heamoglobin dissociation curve. Some responses described the shape of the curve but failed to explain why it is the sigmoidal shape. A few candidates wrote about the different positions of the curves for different species.

This response scores all 3 marks.

4 The graph shows the oxygen dissociation curves of haemoglobin from four species of mammal.



(a) Explain the shape of the haemoglobin dissociation curve.

(3)

The larger the mammal, the further to the left the haemoglobin dissociation curve. The shape is a sigmoid shape due to when the first oxygen molecule binds with the haemoglobin it's harder to bind but it changes the arrangement (shape) of the haemoglobin so this ~~means~~ shows the low affinity but as more oxygen molecules bind it has a higher affinity as the change in structures makes it easier to bind*. The 4th oxygen molecule find it hard to bind so it has a low affinity.
*Shown by sharp increase.

ResultsPlus
Examiner Comments

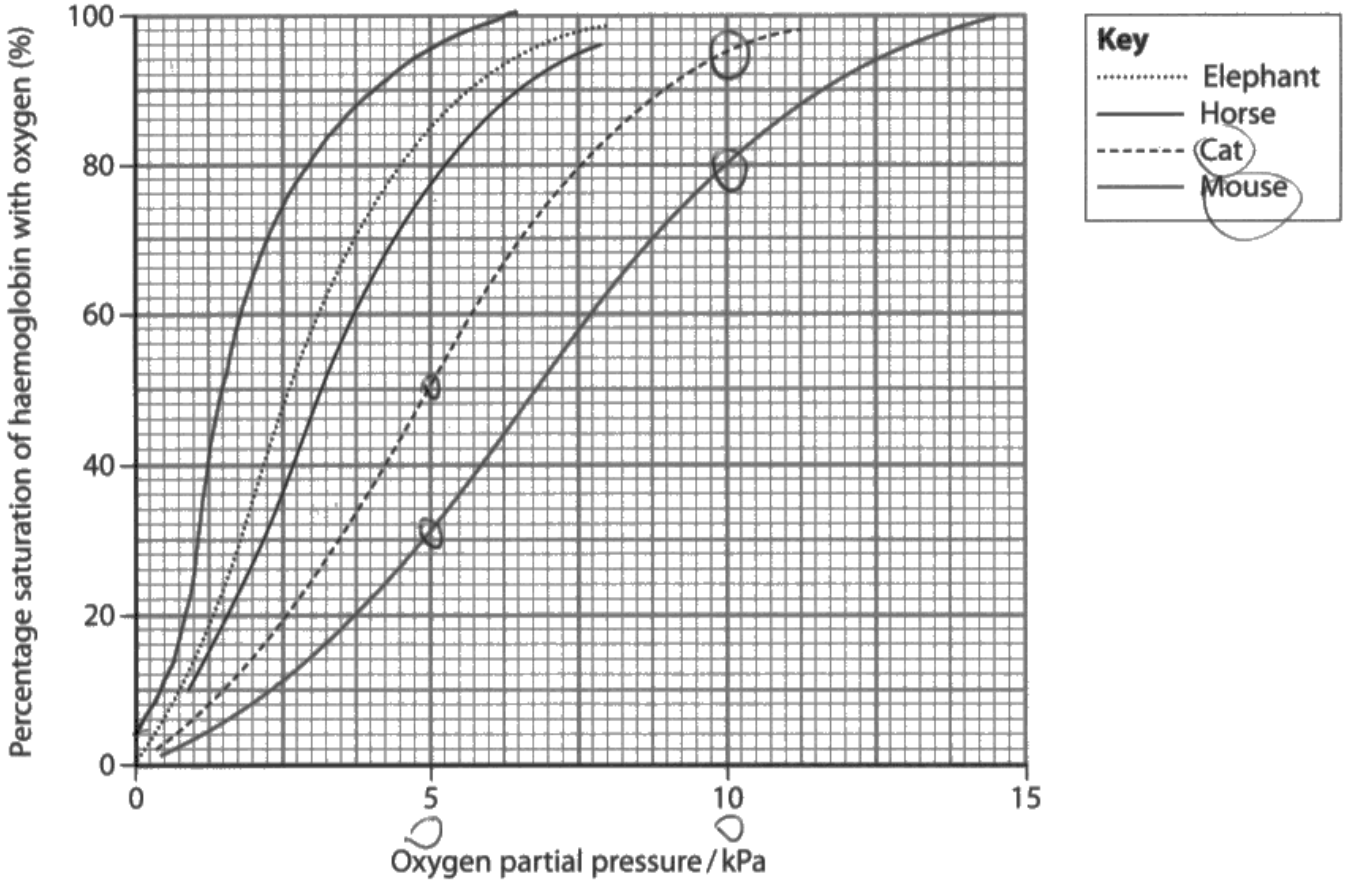
It gains credit for explaining that the shape of the curve is due to the fact that binding of the first oxygen molecule is difficult but this leads to a change in shape of the haemoglobin molecule so binding of further oxygen molecules is easier.

ResultsPlus
Examiner Tip

The first line of the response about the further to the left the curve is irrelevant as it describes the position not the shape of the curve.

This response scores 2 marks.

4 The graph shows the oxygen dissociation curves of haemoglobin from four species of mammal.



(a) Explain the shape of the haemoglobin dissociation curve.

(3)

The shape shows that the first and fourth oxygen molecules binding to the haemoglobin bind less readily than the ~~four~~ second and third oxygens. Also, smaller mammals reach their highest percentage saturation at a higher partial pressure than larger mammals. of oxygen

ResultsPlus
Examiner Comments

It scores 2 marks for explaining that the first oxygen molecule binds less readily to the heamoglobin than the second and third oxygen molecules.

ResultsPlus
Examiner Tip

However the response does not link these ideas to the shape of the curve or the change in the shape of the haemoglobin molecule.

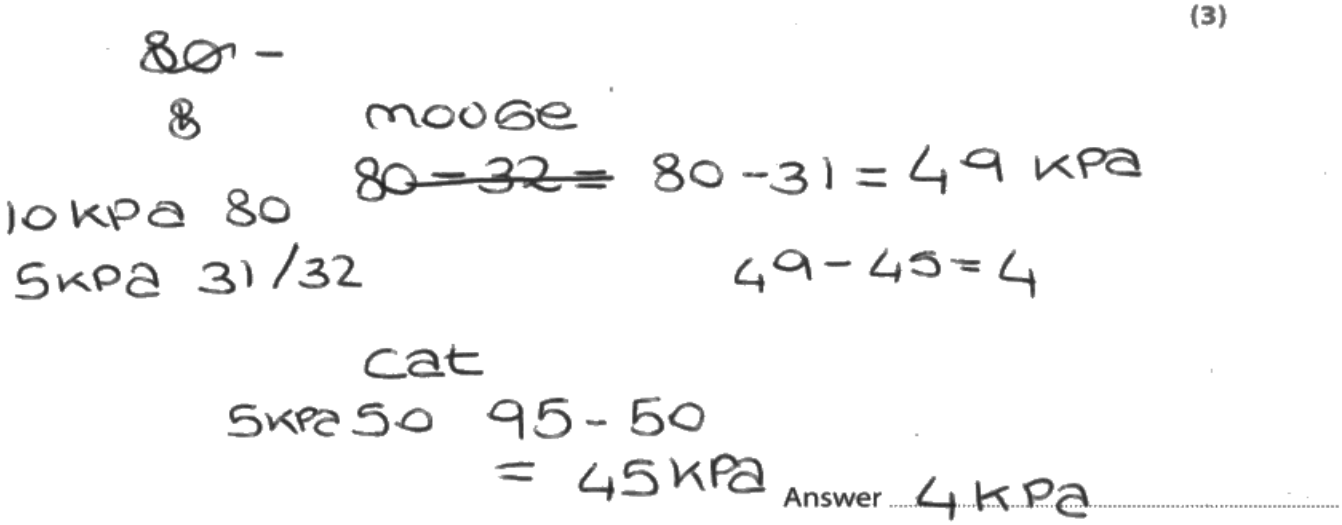
Question 4 (b)

This item required candidates to calculate how much more oxygen is released as the partial pressure falls from 10kPa to 5kPa in the mouse than in the cat.

This response scores all 3 marks.

(b) Calculate how much more oxygen is released as the partial pressure falls from 10 kPa to 5 kPa in the mouse than in the cat.

(3)



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Examiner Comments

The candidates correctly reads the values from the graph of 80 and 31 kPa for the mouse and 95 and 50 kPa for the cat.

They then calculates the fall for each species as 49 and 45.

Finally they subtract these values to obtain the correct answer of 4kPa.

ResultsPlus
Examiner Tip

The response clearly shows the working at each stage.

This response scores 1 mark.

(b) Calculate how much more oxygen is released as the partial pressure falls from 10 kPa to 5 kPa in the mouse than in the cat.

(3)

mouse: $\frac{80 - 31}{5} = 9.8$

cat: $\frac{95 - 50}{50} = 0.9$

$\frac{95 - 50}{5} = 9$

$\frac{80 - 31}{31} = 1.5806$

$9.8 + 9 = 18.8$

Answer 18.8 -/1

ResultsPlus
Examiner Comments

This response scores only the first marking point. The candidate has correctly recorded the values of 10kPa and 5kPa for the mouse and for the cat from the graph.

ResultsPlus
Examiner Tip

Although the candidate has correctly recorded the values for the mouse and for the cat from the graph he has not subtracted these to obtain the fall in kPa nor compared the difference in falls.

Question 4 (c)

This item required candidates to explain the difference in position of the mouse haemoglobin and elephant haemoglobin dissociation curves.

This response scored 3 marks for explaining that the mouse has a larger surface area to volume ratio than the elephant. They also explain that the position of the curve for the mouse haemoglobin indciates a lower affinity for oxygen. They also refer to the mouse having a higher respiration rate.

(c) Explain why the dissociation curve for mouse haemoglobin is to the right-hand side of the dissociation curve for elephant haemoglobin.

(3)

Mice have a larger surface area : volume ratio than elephants. Mice respire more and are more active as they are smaller. Mice have a low affinity for oxygen due to this. This means they struggle to bind oxygen to haemoglobin but due to a higher respiring rate they release oxygen easier. Whereas elephants have a higher affinity for oxygen as they find it easier to bind oxygen to haemoglobin but release less as they don't respire as often.

ResultsPlus
Examiner Comments

Although this response gains 3 marks it could have also referred to the mouse as losing more heat.

ResultsPlus
Examiner Tip

Candidates should develop and include all of the stages in their answers and in this case having written about larger surface area to volume they could have commented on the greater rate of heat loss.

Question 4 (d)

Almost all candidates correctly drew the curve to the left of the horse haemoglobin.

Question 5 (a)

In question 5(a) most candidates could correctly explain how gel electrophoresis separates molecules.

This item scores 2 marks but actually illustrates all 3 marking points.

5 Gel electrophoresis is used to separate biological molecules such as proteins.

(a) Explain how gel electrophoresis separates molecules.

(2)

It seperates molecules a using DNA, this is done by the DNA being placed in an appurates then a electrical current being passed through it. the DNA seperates accoring to its size as smaller maecules move fasier and charge and mass.

ResultsPlus
Examiner Comments

In the first line it gains the first mark by referring to the use of an electric current to separate the molecules. It then goes on to explain that the separation results in smaller molecules moving faster and finally that molecules move according to their charge.

This response also scores 2 marks.

5 Gel electrophoresis is used to separate biological molecules such as proteins.

(a) Explain how gel electrophoresis separates molecules.

(2)

It uses electricity to seperate the different size fragments of DNA. ~~And~~ Smaller fragments travel through the small pores of the agar gel more freely and therefore faster compared to the inhibited large fragments. ~~DNA~~ The phosphate group in DNA has a net negative charge so the fragments migrate towards the positive pole.

ResultsPlus
Examiner Comments

It gains credit for using electricity to separate molecules it also gains credit for smaller molecules move faster and also makes reference to molecules being charged.

ResultsPlus
Examiner Tip

Sometimes more points are worthy of credit than the total marks available. So in this item many candidates made 3 valid points but scored 2 as it is the maximum available.

Question 5 (b) (i)

Question 5(b)(i) told candidates that protein molecules in solution do not separate as easily as DNA fragments. Candidates were then asked to explain how the protein molecules in solution should be treated so that they can be separated by gel electrophoresis.

This reponse scores 2 marks for explaining that smaller fragments need to be produced and a buffer solution should be used.

(i) Protein molecules in solution do not separate as easily as DNA fragments.

Explain how protein molecules in solution must be treated so that they can be separated by gel electrophoresis.

(2)

Protein molecules are larger than DNA so it is cut by enzymes into fragments and is placed in a buffering solution. They must be dyed.

ResultsPlus
Examiner Comments

This candidate understands that large protein molecules need to broken up into fragments. They also appeciate that a buffer solution should be used.

ResultsPlus
Examiner Tip

The response could have also included how the fragments are produced by digesting the protein molecule using protease.

This response also gains both marks.

(i) Protein molecules in solution do not separate as easily as DNA fragments.

Explain how protein molecules in solution must be treated so that they can be separated by gel electrophoresis.

(2)

you must place an enzyme called protease to break the protein into smaller fragments.

ResultsPlus
Examiner Comments

It explains that the protein needs to be broken into smaller fragments using a protease enzyme.

ResultsPlus
Examiner Tip

Candidates are more likely to score if they can name the enzyme such as protease in this case.

Question 5 (b) (ii)

In question 5(b)(ii) candidates were required to analyse the information shown in the photograph to explain how this banding pattern can be used to confirm that these are separate species of fish.

This example scores 3 marks.

(ii) Analyse the information shown in the photograph to explain how this banding pattern can be used to confirm that these are separate species of fish.

(4)

The banding of shark to sturgeon is very different, sturgeon has more bands towards the bottom, this shows that the two species do not share ~~gene~~ similar genetic material and so are separate species of fish. Some of the bands are more thicker than others, this shows variation.

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Examiner Comments

It gains credit for noting that banding pattern is different between species. It gains a second mark for explaining that the bands are in different locations and some are thicker. It also explains that to produce different bands species must have different genetic material.

This response scores all 4 marks available for this item.

(ii) Analyse the information shown in the photograph to explain how this banding pattern can be used to confirm that these are separate species of fish.

(4)

Some species of fish do not produce the same protein as another fish and so some bands ~~were~~ ~~be~~ are not present, and that the pattern and thickness of bands vary. This shows that the fishes do not have the same gene to produce the protein and/or to express it as much as each other. Meaning that they do not interbreed to produce fertile offsprings or have similar characteristics.

ResultsPlus
Examiner Comments

It explains that different species of fish produce different proteins. Therefore there is a differnce in the pattern and the thickness of the bands. This shows that the fishes do not have the same genes to produce the same proteins.

ResultsPlus
Examiner Tip

Although this is a very good response it could be more complete by explaining that the different genes code for the production of different proteins.

Question 5 (b) (iii)

Item 5(b)(iii) required candidates to give a reason why the pure protein samples were included in the gel. Many candidates were able to state that the pure samples were added so that they could be compared to the fish proteins.

Question 5 (b) (iv)

Item 5(b)(iv) required candidates to state what the thickness of the bands indicates. Many responses gained credit for describing that the bands varied in thickness indicating the abundance of that sized fragment in the fish protein. Some responses suggested that the thickness showed the size of the fagment or even the charge on the fragment.

Question 5 (c)

In question 5(c) candidates needed to use the information given in the table to complete the diagram that shows evolutionary relationship between the five species. Most candidates scored both marks for this item indicating that they new how to interpret gel electrophoresis even if they did not completely understand how it works.

Question 6 (a)

Item 6(a) asked candidates to explain how evolution can occur by means of natural selection. Almost all candidates scored marks with about half of responses gaining full credit. As with many of the longer items some of the candidates could not express themselves in a way that clearly demonstrated understanding.

This example earns full credit.

6 Natural selection can lead to adaptations in organisms.

(a) Explain how evolution can occur through natural selection.

(3)

Natural selection : each species has varied DNA leading to each offspring born with different characteristics. ~~This~~ The offspring can be alot and causes competition, survival of the fittest. The organism with the most advantageous characteristics can survive most likely and pass on their genes. The organisms with the most disadvantageous characteristics are not likely to survive and cannot live to reproduce. Therefore, the organisms that survive evolve and pass on their advantageous characteristics enabling them to adapt to environments easily

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Examiner Comments

It scores marks for describing variation in DNA. It explains how some indviduals will have more advantageous characteristics and that these individuals are more likely to survive and reproduce. The genes for these characteristics will thus be passed on to their offspring.

ResultsPlus
Examiner Tip

We would prefer candidates to refer to alleles being passed on rather than genes. This response would be further improved by explaining that mutation is a source of genetic variation.

This second example also scores the full 3 marks.

6 Natural selection can lead to adaptations in organisms.

(a) Explain how evolution can occur through natural selection.

(3)

✓ Genetic variation by mutations in the DNA can occur within the population.
✓ Organisms with the advantageous alleles survive and reproduce
✓ The advantageous allele is passed on to the offspring
✓ The advantageous allele leads to adaptations that improve the chances of survival
✓ Differences in selection pressure
✓ Selection pressures can will lead to

ResultsPlus
Examiner Comments

This example is set out in a logical order. It includes all 4 marking points for a maximum score of 3.

It clearly states that genetic variation in a population can occur due to mutation, that some organisms may have alleles that lead to adaptations that increase the chance of survival and reproduction and that the advantageous alles are passed on to offspring.

Question 6 (c) (ii)

Almost all candidates were able to correctly give one method that a scientist could use to inform the scientific community about the discovery of a new species. Suitable answers included peer reviewed journals and scientific conferences.

Question 6 (d)

Item 6(d) required candidates to compare and contrast allopatric and sympatric speciation. To score full marks responses needed to include both similarities and differences between the types of speciation.

This item required candidates to compare and contrast allopatric and sympatric speciation. This example scored 3 marks. It gave 2 differences but only one similarity.

(d) Compare and contrast allopatric and sympatric speciation.

(4)

Allopatric speciation is when 2 speaes are seperated geographically and a physical barrier is placed between them e.g islands, mountains. ~~Thes~~ The 2 populations lose contact and cannot reproduce with each other and could became endemic species.

Sympatric speciation is when 2 & species live in the same area but is seperated by mechanical, behavourial speciation. They cannot mate anymore &. may have been caused by a mutation that changed the mate calling or genitals of the species which the other population can't physically reproduce or recognise each other, causing ~~spe~~ seperate population evolving away.

(Total for Question 6 = 12 marks)

ResultsPlus
Examiner Comments

It stated that allopatric requires geographic separation. It also states that sympatric speciation involves behavioural or mechanical bariers. It also describes allopatric speciation as cannot reproduce and then later in the second paragraph describes asympatric as being unable to mate.

ResultsPlus
Examiner Tip

In an answer that requires similarites and differences or compare and contrast it is clearer if the candidate writes out the similarities and then the differences. Rather than just decribing or writing about each type in turn and expecting the examiner to make the comparisons.

Question 7 (a)

Question 7 described an investigation into the effect of shape on the rate of absorption of water. In part (a) candidates had to calculate the surface area to volume ratio of one of the shapes. About half of the responses scored 2 or more marks. Many candidates could successfully determine the values but then did not express them in a simple ratio.

Question 7 (b)

In item 7(b) candidates had to rank order the shapes in the order that they would absorb in from the slowest to the fastest. About half of the candidates recognised that shape A had the smallest SA/Vol so would absorb water the slowest.

Question 7 (c)

Item 7c asked candidates to devise an investigation to determine the effect of shape on the rate of absoprtion of water by potato.

This item was marked using a level based mark scheme. To gain level one answers needed to include two of the following ideas: using several of each different shapes placed in water for a stated time of over 10 minutes.

In order to achieve level two responses needed to additonally include reference to two of the following ideas: controlling temperature, controlling the type of poatato, measuring a suitable dependent variable such as mass or volume of poatato or volume of water absorbed and the cacluation of mean values.

In order to achieve level three responses must in addition to the level one and two ideas, include two of the following ideas: submerge the potato in water, blott the potato dry before weighing, control the mass or volume of each shape and calculate the rate of absorption in g min^{-1}.

This example was a level 2 response scoring 4 marks.

*(c) Devise an investigation to determine the effect of shape on the rate of absorption of water by potato chips.

(6)

1) Cut equal sized cylinders of potato chips of different sizes and have 5 sizes (1cm, 2cm, 3cm, 4cm, 5cm)
2) Weigh the potato before you put potatoes in water
3) Measure the same volume of water for each cylinder ($10cm^3$)
4) Weigh the potato again after 10 minutes and use a stop watch to make sure time is kept the same.
5) Repeat the experiment 3 times to calculate a mean.
6) Subtract / work out the difference in weight.
7) Control variables such as temperature by using a water bath and make sure the age and species of potato is the same.

ResultsPlus
Examiner Comments

The response gains level one by including reference to different size chips that are put in water for 10 minutes. Also the experiment is repeated 3 times to calculate a mean. It makes reference to controlling temperature and species of potato so gains at least 2 ideas from level 2.

It does not make reference to any ideas from the level 3.

ResultsPlus
Examiner Tip

This response includes lots of the ideas from level 1 and 2 but none from level 3 so scores 4 marks.

This example earns level 3 and scores 6 marks.

*(c) Devise an investigation to determine the effect of shape on the rate of absorption of water by potato chips.

(6)

Cut out of the same type of potato 5 of each shapes A, B and C. Weigh each individual shape and record in a table. Each ~~A,B and C~~ One set of one of each shapes will be used for 1 minutes, 2, 3 and 4 minutes. Put each potato into a ~~beaker~~ seperate beaker filled with 150ml of distilled water making sure the whole shape is submerged. Set the timers. At the end of each test blot with tissue paper delicatly to eliminate excess water then weigh and put in the correct place in the table. Calculate the change in weight by taking the first weight away from the second ~~to~~ and you'll see the water uptake. You be able to see the rate per minute from your result Make sure to repeat 3 times and find an average.

time	start weight (g)			end weight (g)		
	Shape A	Shape B	Shape C	A	B	C
1						
2						
3						
x						
5						

ResultsPlus
Examiner Comments

This response includes 3 ideas from level 1 using different shapes (A, B and C) and 5 of each and place them in distilled water. It also includes 2 ideas from level 2 weighing each potato and using the same type of potato. Finally it includes 3 ideas from level 3 submerging the potato, drying them gently with tissue paper and in the table showing results in g and refering to per minute in the answer.

ResultsPlus
Examiner Tip

Candidates need to use their experience from practcal work during the course and be sure to include independent, dependent and control variables and explain how these can be measured or controlled.

Question 8 (a)

Question 8(a) required candidates to describe three diffrences between the apoplastic and the symplastic pathways. Most responses gained some credit but only the best scored all three marks.

This response scores 3 marks.

8 Water enters a plant through root hair cells and then travels by the apoplastic and by the symplastic pathways.

(a) Describe the differences between the apoplastic and the symplastic pathways.

(3)

Apoplastic pathway is diffusion through the cell wall. Symplastic pathway is through the cytoplasm. Symplastic pathway can be carried out all the way through to the xylem but apoplastic pathway is stopped before the xylem ~~but~~ by the ~~Casp~~ Casparian strip so enters xylem through symplastic pathway.

ResultsPlus
Examiner Comments

This response gained 3 marks for correct reference to apoplastic using diffusion through the cell walls. It aslo gained a mark for reference to apoplastic pathway being stopped by the Casparian strip.

This example also scores 3 marks.

8 Water enters a plant through root hair cells and then travels by the apoplastic and by the symplastic pathways.

(a) Describe the differences between the apoplastic and the symplastic pathways.

(3)

The apoplastic pathway mainly involves travel through the cell wall whereas the symplast involves transport through the living part of the cell, mainly the cytoplasm. The Apoplast pathway is blocked by the casparian strip whereas the Symplast is not.

ResultsPlus
Examiner Comments

This scores 3 marks for reference to the apoplastic pathway involving travel through cell walls. It also describes the symplastic pathway as living and finally scores a third mark for describing the apoplastic pathway as being blocked by the Casparian strip.

Question 8 (b) (i)

This item required candidates to explain how the properties of herbicide molecules affects their ability to pass through cell membranes. Many candidates failed to score on this item as they did not read the question carefully and recognise that they needed to consider how the properties of different molecules can affect their ability pass through the cell membrane. Many responses just described one type of molecule.

This response scores only 1 mark.

(b) Herbicides are chemicals used to control the growth of weeds.

Herbicides that are absorbed from the soil also travel through the apoplastic and symplastic pathways.

The rate of absorption of herbicides is affected by their chemical properties.

(i) Explain how the properties of herbicide molecules affect their ability to pass through plant cell membranes.

water soluble
polar channel proteins
+ large molecules (3)

Plant cell membranes only allow polar molecules to be passed through channel/carrier proteins. Herbicide must travel through these proteins as the herbicide is water soluble and the outer membrane does is hydrophobic.

ResultsPlus
Examiner Comments

This response scores one mark for explaining that polar and large molecules would need to pass through using channel proteins.

ResultsPlus
Examiner Tip

To score higher, candidates needed to link the type of molecule with the mechanism of movement so this response could have gained another mark if they added through channel proteins by facilliated diffusion.

This response also scores 1 mark.

(b) Herbicides are chemicals used to control the growth of weeds.

Herbicides that are absorbed from the soil also travel through the apoplastic and symplastic pathways.

The rate of absorption of herbicides is affected by their chemical properties.

(i) Explain how the properties of herbicide molecules affect their ability to pass through plant cell membranes.

(3)

They need to diffuse into the symplastic pathway s. large polar molecules ~~need~~ cant diffuse by simple diffusion but by facilitated diffusion or active transport.

ResultsPlus
Examiner Comments

This response scores 1 mark for explaining that large polar molecules must pass by facilitated diffusion or active transport.

ResultsPlus
Examiner Tip

This candidate could have scored another mark if they had explained that the diffusion must occur via channel proteins.

Question 8 (b) (ii)

This item required candidates to explain how herbicides applied to the soil will be transported to the leaves. Many candidates scored at least 1 mark but only a small percentage scored both marks.

This response scores 1 mark for explaining the way the herbicide goes up to the leaves.

(ii) Some herbicides are applied to the soil.

Explain how these herbicides will be transported to the leaves.

(2)

they will be transported ~~through~~ by transpiration.
the herbicide molecules will cohesive itself together
due to it being polar, then they will adhesive ~~itself~~ to
itself and the xylem cell ~~wall~~ wall and be transport
-ed ~~a~~ up to the leaves.
the herbicides may mix with the ~~H2O~~ water molecules. and
transport itself using the water molecules

ResultsPlus
Examiner Comments

This scores 1 mark for explaining that the herbicide could be carried by the transpiration stream in the xylem.

ResultsPlus
Examiner Tip

This response could be improved by stating how the herbicide enters the plant.

This response sores both marks for explaining how the herbicide enters the roots of the plant and how it moves to the leaves.

(ii) Some herbicides are applied to the soil.

Explain how these herbicides will be transported to the leaves.

(2)

The herbicides will enter the root hair cells via facilirated diffusion or active transport. It will then travel through the phloem, and then join the transpiration stream through the xylem until it reaches the leaves

ResultsPlus
Examiner Comments

This response scores a mark for explaining that the herbicide can diffuse into the plant root hair cells. It scores a second mark for explaining that the herbicide can travel up the xylem in the transpiration stream.

Question 8 (c)

The final item on the paper required candidates to explain why the humidity in a glasshouse would be higher in the summer than in the winter. Almost all candidates were able to score at least 1 mark but only the very best scored 3 or 4 marks.

This example scores 3 marks for explaining that in the summer the temperature is higher. This gives water molecules more kinetic energy and transpiration increases.

(c) To grow plants successfully in a glasshouse, the humidity needs to be controlled because the humidity would be higher in the summer than in the spring.

Explain why the humidity in a glasshouse would be higher in the summer than in the spring.

(5)

The temperature in summer is higher than spring and a greenhouse is enclosed from outside, the water molecules in the greenhouse would be provided with more kenetic energy and so more H_2O would be in a gaseous state. Due to enclosed environment the level of H_2O in the ~~gre~~ air in greenhouse increase, increase in humidity. The plants will transpire more ~~due~~ ~~to more energy in~~ ~~H_2O~~ at start of summer.

ResultsPlus
Examiner Comments

The response scores credit for increased temperature leading to increased kinetic energy of the water molecules and so increased transpiration.

ResultsPlus
Examiner Tip

It makes no reference to increased daylight hours meaning that stomata would be open for longer or open wider. It also makes no reference to increased leaf area in the summer.

This example also scores 3 marks.

(c) To grow plants successfully in a glasshouse, the humidity needs to be controlled because the humidity would be higher in the summer than in the spring.

Explain why the humidity in a glasshouse would be higher in the summer than in the spring.

(5)

The plants in the spring are growing so don't have many leaves that water can evaporate and diffuse out of the stomata. Whereas in summer most of the leaves have grown and therefore more water vapour diffuses out. Furthermore in summer the weather is hotter which gives the water particles more energy so the evaporate quicker and therefore more water is lost compared to spring where the temperature is cooler.

ResultsPlus
Examiner Comments

It makes reference to smaller leaves or leaf area in the spring which is acceptable as converse of the last marking point. It also explains that in summer there will be more evaporation and that it is hotter in summer.

ResultsPlus
Examiner Tip

This response does not make reference to increased width or duration of stomatal opening or increased kinetic energy of water molecules.

Paper Summary

The paper was able to discriminate across the range of candidates. The two items that proved the most difficult were 3(c)(i) and 3(c)(ii) in which candidate responses were often lacking depth and explanation. In these items only a few responses scored higher marks. The items that most candidates answered correctly were the objective responses 6(b)(i) and 6(b)(ii) which were correctly answered by about 90% of candidates. The longer items enabled candidates to show their knowledge and understanding in more depth and detail but sometimes candidates did not write using precise language such as in items 5(b)(ii) and in 8(c) but in others such as 6(d) they wrote well. The examiners were pleased to note that the investigation design item, 7(c), enabled many candidates to demonstrate their understanding of experimental design and procedures and this item produced a good range of scores from weak to very good. Candidates generally scored well on the mathematical items such as 3(a), 2(b)(i), 4(b) and 7(a).

Based on their performance on this paper, candidates 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
- always show stages of working in calculations, so that if an error is made, for example, in reading values of a graph, some credit can still be gained
- make sure you have expressed your answer to the appropriate significant figures and include the correct units
- remember to use the knowledge and skills aquired during practical work to help in indirect practical skills items
- in experimental design items always be able to name the independent variable and give the range of values, 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

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

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