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Examiners' Report
June 2019

GCE Biology 9BI0 02

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Introduction

The general standard of answers from candidates was better than last summer. Many candidates showed an excellent factual knowledge of all the topic areas covered by this paper and the examiners commented on the general improvement of the way in which candidates structured their answers. Centres are clearly preparing candidates well for the examination and have now fully appreciated the demands of the reformed specification.

Most candidates are now much clearer on the meaning of all the different command words and it was pleasing to see that fewer candidates confused instructions such as 'describe' and 'explain.' Some candidates still find the analysis of unfamiliar data challenging and have a tendency to underestimate the level of detail which is required at A Level. Candidates should always try to use precise and accurate scientific vocabulary where appropriate.

Mathematical skills were generally good, although it was surprising to see how many candidates were unable to carry out Hardy-Weinberg calculations or calculate a species diversity index. The specification lists certain quantitative and statistical methods which candidates are expected to be familiar with. The majority of candidates completed the paper and very few seemed to be under time pressure.

It is essential that candidates write down all their thought processes on paper. Marks can only be awarded for work which has been presented. Some candidates clearly carry out the mental steps needed to reach answers but do not gain credit as the steps were not written down. One issue that many examiners commented on was the high number of scripts where writing was difficult to read; candidates should be reminded that, although the examiners try very hard to read even the most illegible writing, it may not always be possible to decipher it. Candidates should also be reminded to not write outside the answer area where it may not be noticed. If extra space is needed, they should request additional sheets of paper.

Question 1 (a) (i)

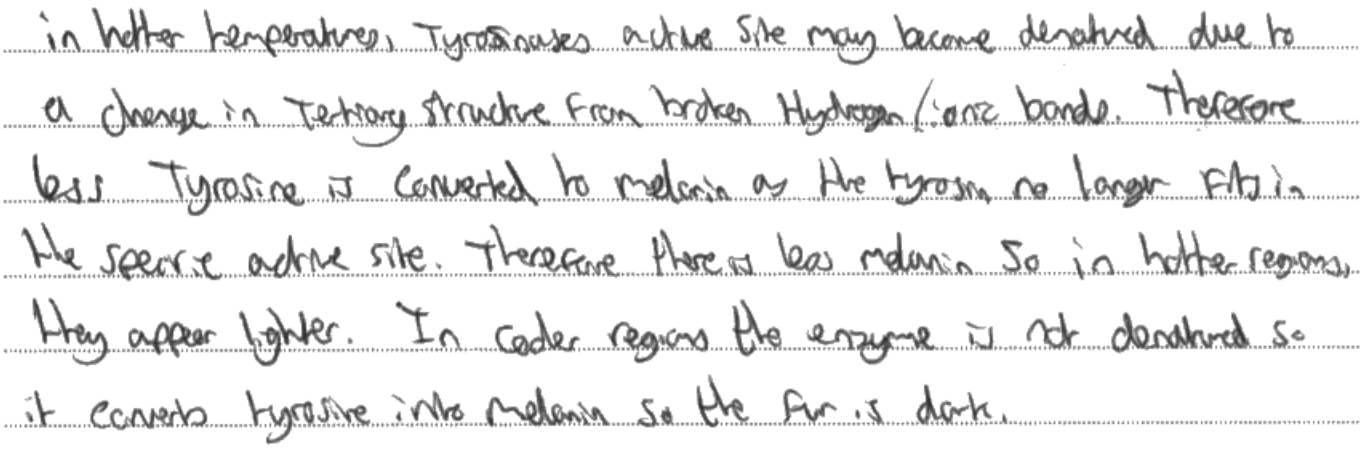
Most candidates were able to give the correct mRNA sequence. A few candidates incorrectly wrote 'thymine' instead of 'uracil'.

Question 1 (b) (ii)

This question generated a broad range of responses. Some candidates wrote excellent, detailed answers which fully explained why tyrosinase is only active in the cooler regions of skin. A few candidates understood that the enzyme would not be active in the warmer regions but did not continue to provide a detailed explanation of the reasons for this. They often gave vague references to the enzyme structure being changed but did not refer to the tertiary structure. Candidates should always give full details such as secondary or tertiary structure when appropriate. Some candidates misunderstood the emphasis of the question and gave answers which considered thermoregulation of the cat and a few candidates thought that the enzyme was more active in the warmer parts of the cat, suggesting that it would have more kinetic energy.

(ii) Explain why the cooler regions of a Siamese cat have dark coloured fur and the warmer regions have lighter coloured fur.

(3)



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Examiner Comments

This candidate gained all three marks. They correctly state that the enzyme would denature, providing details about the breaking of hydrogen bonds, and continued to state that tyrosine will no longer fit in the active site and so melanin is no longer produced.

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Examiner Tip

Always give full details when discussing enzyme denaturation.

Change in temperature can have an effect on the structure of protein - increasing temperatures can break the hydrogen bonds and so alter the structure of the protein (e.g. it can denature enzymes as it changes the shape of the active site). The mutation may mean that the ~~the~~ slight temperature differences in the cat change the protein, giving it a lighter colour

ResultsPlus
Examiner Comments

This answer gained two marks. There is a correct explanation of the breaking of hydrogen bonds / denaturation with the consequence of the active site shape changing.

ResultsPlus
Examiner Tip

Always finish answers. Don't just stop at active site changes; keep going to explain the consequence of this.

in cooler regions the enzyme tyrosinase works at its optimium rate. This means more tyrosine is converted to melanin as more enzyme substrate complex are formed leading to increased melanin meaning black fur. In waemer conditions the temperature is too high, not optimum for tyrosinase enzyme. This causes bonding in enzyme to be disrupted "ionic bonds" causing the active site to denature so less trosinase is converted to melanin meaning they have lighter fur.

(Total for Question 1 = 6 marks)

ResultsPlus
Examiner Comments

This answer gained all three marks. The candidate clearly states that the cooler regions are optimal for the enzyme and proceeds to explain that ionic bonds will break in the warmer regions, altering the active site.

Cooler regions contain more tyrosinase so more tyrosine is converted into melanin. This means that there is more melanin so the fur turns black. Whereas in the warmer regions there is less tyrosinase so less tyrosine is converted into melanin.

ResultsPlus
Examiner Comments

This answer gained one mark. The candidate has correctly stated that melanin is not produced in the warmer regions but has not given any further detail.

Question 2 (b)

This question generated a wide range of responses. Some candidates gave excellent accounts of how the resting potential is set up, with correct references to: the sodium-potassium exchange pump, the diffusion of potassium ions out of the neurone through channels, the relative impermeability of the membrane to sodium ions and the resulting relative positive charge on the outside of the membrane. There were also a surprising number of very confused accounts. Some candidates referred to the movement of sodium into the neurone, others considered that potassium was negatively charged. Other common errors included giving descriptions of action potentials and depolarisation rather than the resting potential and suggesting that sodium diffuses out of the neurone. Candidates need to be very clear regarding the roles of sodium and potassium ions when discussing neurone activity.

(b) Explain how the resting potential is maintained in a neurone.

(4)

The resting potential of a neurone is -70mV, this is maintained by the sodium, potassium ion gated channels. 3 sodium (Na^+) ions move out to the surf membrane of the neuron and 2 potassium (K^+) ions enter the neurone membrane. This causes the membrane to be more negative than the outside of the membrane as K^+ ions are more negative than Na^+. The Na^+/K^+ channels are also leaky to be which allows more Na^+ ions to leave the membrane making it more negative. The channels are always open which allows the resting potential of -70mV to be maintained.

ResultsPlus
Examiner Comments

This answer gained one mark for the correct movement of sodium ions out and potassium ions in. They did not refer to the sodium-potassium exchange pump and were not clear about the relative charge of both sides of the membrane.

ResultsPlus
Examiner Tip

Make sure that you are clear as to the direction of movement of the different ions.

• Resting potential in a neurone is maintained by the potential difference across the membrane of a nerve fibre.

• There are is a potassium–sodium pump within the membrane of a nerve fibre which actively, using ATP pumps 3 Na^+ ions out of the nerve fibre and 2 K^+ ions into the nerve fibre.

• There are also K^+ ion channels in the nerve fibre, so the K^+ ions that are pumped in more than out by through these. as the membrane is more permeable to K^+ ions.

• The Na^+ ions cannot move back in once they have been pumped out of the nerve fibre and thus this creates a potential difference.

• The outside is more positive, and the inside is more negative.

• Resting potential is -70mV.

ResultsPlus
Examiner Comments

This is a very strong answer which gained all four marks. There is a clear reference to the sodium-potassium exchange pump and the candidate continues to describe the movement of ions correctly as well as the effect this has on the membrane polarity. The answer is organised in a logical, flowing style.

ResultsPlus
Examiner Tip

Try to organise your answers in a sensible order.

resting potential is maintained by the outside remaining more posche than the inside cause the inside to become around -70mV. first there is a high concentration of sodium ions inside the axon and more potassium outside from achon potential so the sodium potassium pump sends 3Na+ out and 2K+ in causing the outside to become more negative (posche) compared to outside causing inside to become polarised the potassium can leave through potassium channels by facilitated diffusion but the membrane is impermeable to sodium so lots more potassium leave causing the inside to become negative cause resting potential

ResultsPlus
Examiner Comments

This is also a strong answer which gains all four marks. The candidate explains how the outside of the neurone is made more positive by the action of the sodium-potassium exchange pump, continuing to fully explain the relative movements of the sodium ions and potassium ions.

Neurons ~~have~~ send electrical impulses, this means that they have a charge. In order to maintain this, (Resting potential), several steps take place. The neuron has positive charge, which imbalances, with the negatively charged blood. The positive charge is due to ~~Calcium~~ Potassium, and the negative charge is due to sodium. The rebalancing occurs when a signal has been sent. Calcium opens the neurons channels, and allows the negative and positive ions to disociate, and rebalance, repolarise.

ResultsPlus
Examiner Comments

This answer gained no credit. There are no correct references to the roles of the sodium and potassium ions and the ideas about the charge across the neurone membrane are confused.

Question 2 (c)

This question was answered well by many candidates. Some candidates gave excellent, detailed answers which fully explained the effect tetrodotoxin has on blocking voltage gated sodium channels. Less able candidates often gained one mark for correctly describing the reduced potential difference but did not go on to explain how this occurred. A few candidates confused the question with synaptic activity and gave answers which referred to neurotransmitter receptors and inhibition of EPSPS. Candidates should understand the role of voltage gated sodium channels in the generation of action potentials and be able to relate this to data.

Comment on how tetrodotoxin affects the potential difference of a neurone when the prey of the octopus is paralysed.

(4)

When Tetrodotoxin is presence, it prevents the neurone creating an action potential, as the potential difference with tetrodotoxin (around -50mV) is not high enough ~~for depolarisation~~ depolarisation to create an action potential compared to without tetrodotoxin (around +60mV), so an impulse cannot be passed on and so results in paralysis as the motor neurones cannot pass the impulse on to the effectors (such as muscles). Tetrodotoxin greatly reduces the potential difference of a neurone, by closing sodium channels in membrane

ResultsPlus
Examiner Comments

This is a very strong answer which gained all four marks. The candidate clearly implies that the potential difference is less than without tetrodotoxin and goes on to explain that there is no action potential due to sodium ions being closed and thus no impulses go to the effectors.

In the presence of tetrodotoxin, an action potential cannot happen. This is because the potential difference does not reach the threshold level, and action potentials are all-or nothing, so therefore will not occur. So the potential difference is much smaller in the presence of tetrodotoxin than it is in its absence. This would paralyse prey as action potentials are not able to be produced in the presence of tetrodotoxin, so nerve impulses cannot be sent, resulting in paralysis.

(Total for Question 2 = 10 marks)

ResultsPlus
Examiner Comments

This answer gained two marks for stating that the potential difference is not as high and that there is no action potential. The candidate does not give any further explanation.

When tetrodotoxin is absent, an action potential occurs in the neurone, meaning nerve impulses can be carried. When tetrodotoxin is present, depolarisation is unsuccessful, meaning the sodium ions haven't been able to & enter the cell. This means the action potential cannot occur and so the nerve impulses cannot be carried.

ResultsPlus
Examiner Comments

This answer gained two marks for stating that there is no action potential as sodium ions do not enter the cell. Mark point one was not awarded as the reduced depolarisation was not clear.

Question 3 (b) (i)

Many candidates were able to gain at least one mark for this question, however, few gave sufficient detail to gain both marks. The majority of candidates clearly appreciated that the lytic cycle leads to the production of viruses and their release from cells but fewer stated that, during the lytic cycle, viral proteins or translation of viral RNA occurs. A few candidates confused the lytic cycle with latency.

(b) Ebola virus begins its lytic cycle soon after the infection of body cells.

(i) Describe the lytic cycle of a virus.

(2)

A virus begins to multipy in a cell

ResultsPlus Examiner Comments

This answer gained zero. The candidates correctly states that viruses replicate but does not go on to say that they exit the cells.

(2)

Where the virus replicates inside the cell, after entering its genetic material, making new protein coats and the virus multiplying, ~~usin~~ and then bursting out the cell and going to attack others.

ResultsPlus Examiner Comments

This answer gained both marks. The candidate clearly states that the viruses replicate and leave the cell and also explains that new viral proteins are made.

DNA or genetic material from the virus is injected into the host cell when the virus attaches, the virus replicates, causing the cell to burst, releasing the virus which is virulent.

ResultsPlus
Examiner Comments

This answer gained one mark for correctly explaining that the lytic cycle results in viral replication and the exit of viruses from cells. No mention is made of translation or protein synthesis so mark point two was not awarded.

Question 3 (b) (ii)

Many candidates correctly stated that latency occurs when the virus is dormant. Some excellent answers were seen which fully explained the integration of the viral genome into the host cell and its possible transfer when host cells undergo mitosis. Candidates should always try to refer to the correct terminology when writing their answers; this was evident in some of the very strong answers seen. A few candidates confused latency with the lytic cycle and a few gave overly simplistic references to the virus not being harmful.

(ii) Some doctors believe that the Ebola virus may undergo latency within body cells.

State what is meant by the term latency.

(2)

latency means that the virus remains dormant, it does not begin effecting the body's cells until an environmental factor triggers it to do so.

ResultsPlus
Examiner Comments

This answer gained one mark. The candidate clearly states that latency refers to a dormant period but does not give any further detail.

Viral DNA integrates into the cells DNA and is replicated when the cell undergoes mitosis. The viral is not transcribed for a long time but when it is the effects of the virus return.

ResultsPlus
Examiner Comments

This is a very good answer that gained two marks. The candidate clearly explains how the viral genome integrates into the cells and then continues to say that the genome is replicated during cell mitosis.

The virus stays inside the host cell undetected and not causing harm for a period of time remaining latent.

ResultsPlus
Examiner Comments

This answer did not gain any credit. The candidate has not clearly implied a dormancy period and the answer is very vague.

Question 3 (c)

A wide range of answers were seen, with most candidates gaining at least one mark but only the very strongest gaining all four. The majority of candidates were able to recognise that Zmapp was effective and were able to describe the general trend that more people survived. Commendably, many candidates looked closely at the data and spotted that the effectiveness of Zmapp seems to be from day 5 or 6 onwards. The examiners commented on how encouraging it is to see that candidates are looking carefully at data trends to spot less obvious patterns. A significant number of candidates gained credit for recognising that the side effects decreased over time. Only a minority of candidates looked for evidence to suggest that Zmapp was not effective; candidates should explore all aspects of an issue carefully when 'assessing' data.

(c) An experimental drug called Zmapp was used to treat patients during this outbreak of Ebola virus.

Patients with Ebola virus were randomly split into two groups.

Both groups received standard medical treatment.

One group was also given Zmapp on days 1, 3 and 5.

Some of the patients suffered severe side effects after treatment with Zmapp and required additional medical care.

The results are shown in the table.

Day	Number of patients surviving		Number of patients with severe side effects after treatment with Zmapp on days 1, 3 and 5
	Without Zmapp	With Zmapp	
1	35	36	11
2	32	33	
3	31	31	7
4	30	29	
5	29	28	3
6	26	28	
7	23	28	
8	22	28	
9	22	28	

Analyse the data to assess the effectiveness of Zmapp to treat patients with Ebola virus.

(4)

63% of people not treated with Zmapp were alive on day 8, while 78% of people on Zmapp were alive on day 8, meaning Zmapp was for effective at keeping people alive.
However 31% of people had severe side effects after the first dose of Zmapp which may have worsened their condition or caused death. people stopped dying after day 5 on Zmapp while people stopped dying on day 8 without it, meaning Zmapp was effective at preventing deaths ~~8 days before~~ 3 days before those who were not on it.

(Total for Question 3 = 9 marks)

ResultsPlus
Examiner Comments

This answer gained two marks. The candidate clearly explains that Zmapp is effective to gain mark point one and strongly implies the increased survival after day five. Side effects are mentioned but there is no mention of them reducing.

750 269

Analyse the data to assess the effectiveness of Zmapp to treat patients with Ebola virus.

1.076 (4)

- Number of patients surviving is greater with Zamp.
- number of patients surviving using/with Zamp is 1.076 times more than that of patients without Zamp.
- For both treatments after day 6 there are no patients with severe side effects after day6.
- Overall treatment is effective as only a few people suffer from severe side effects.

ResultsPlus
Examiner Comments

This answer gained one mark for mentioning the improved survival with Zmapp. There is a mention of side effects but this is not clearly related to the use of Zmapp.

Zmapp does decrease number of patients with severe side effects. from day 1 to day 5 there was a decrease of 8 patients who experienced severe side effects. No data after days.
Number of patients surviving is fairly similar with & without Zmapp up to day 5.
After day 5 number of patients surviving with Zmapp is higher than without e.g day 7 23 surviving without but 28 with. After day 5 number of patients surviving with Zmapp stays at 28 / doesnt change.

(Total for Question 3 = 9 marks)

ResultsPlus
Examiner Comments

This is a good answer which gained three marks. The candidate clearly states that more patients survive with Zmapp and also notes the change in patterns at day five. The reduction in side effects was also given credit.

Without Zmapp the number of patients surviving kept decreasing over the 9 days - overall decreased by 13. However with Zmapp, after day 5 - last dose - no more patients died, number of surviving patients stayed constant at 28, so overall only 8 people died. The number of patients suffering severe side effects also decreased after successive dosages of Zmapp. Zmapp is effective because less patients died in the group with Zmapp. However this may not be reliable because sample groups were small and 8 people still died with Zmapp meaning the difference might only be due to chance. Also it could be the people with the side effects who died. Zmapp side effects occurred on 11/36 people & made situation worse.

(Total for Question 3 = 9 marks)

ResultsPlus
Examiner Comments

This is an excellent answer which gained all four marks. The candidate clearly states that more people survive with Zmapp and notes that the difference is more significant after day five. They also recognise that side effects reduce over time and that the sample size is small.

Question 4 (a)

Most candidates were able to list all four correct genotypes. A significant number, however, omitted one genotype or gave separate genotypes for each pair of alleles, for example, AA, Aa and BB, Bb.

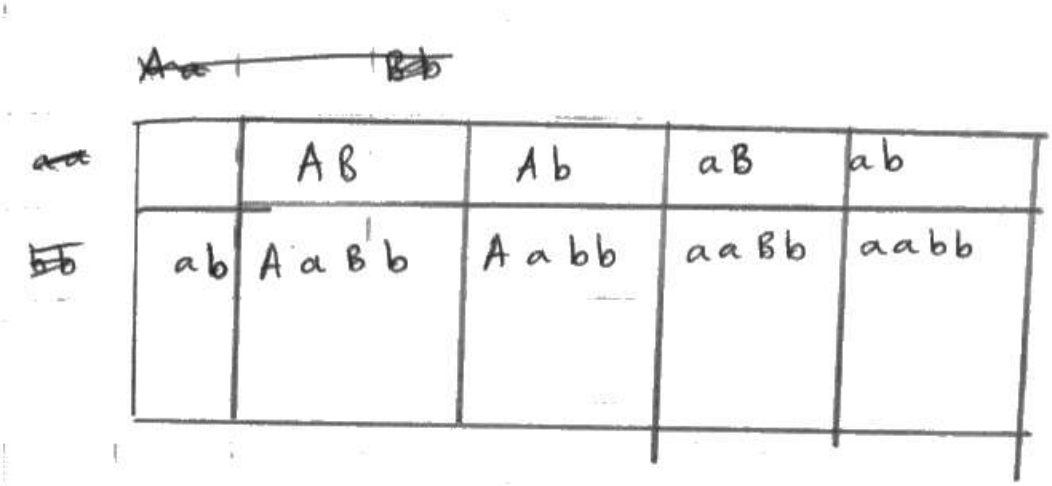
Question 4 (c)

This question produced a mixed quality of responses. Many candidates gave detailed genetic crosses, stating the parental genotypes and gametes clearly. A significant number of candidates did not read the question carefully and stated both parental genotypes as heterozygous. The quality of some of the genetic diagrams drawn by candidates was poor and made it difficult for examiners to follow. Candidates should set out genetic crosses clearly and state the parental genotypes and gametes.

(c) A student cross-pollinated a maize plant grown from a smooth, purple grain (heterozygous for both pairs of alleles) with a maize plant grown from a wrinkled, yellow grain.

Using a genetic diagram, determine the probability that this cross will produce grains that are wrinkled and purple.

(4)



Answer 50%

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Examiner Comments

This answer was awarded two marks for the correct gametes and F_1 genotypes. The parental genotypes are not stated and the final answer is incorrect.

Aa Bb

(c) A student cross-pollinated a maize plant grown from a smooth, purple grain (heterozygous for both pairs of alleles) with a maize plant grown from a wrinkled, yellow grain.

aa bb

Using a genetic diagram, determine the probability that this cross will produce grains that are wrinkled and purple.

B

aa

(4)

	A	a
B	A B	a B
b	A b	a b

	a	a
b	a b	a b
b	a b	a b

	A B	A b	a B	a b
ab	Aa Bb	Aa bb	aa Bb	aa bb

wrinkled and purple

Answer 1/4



ResultsPlus
Examiner Comments

This answer gained all four marks. The parental gametes are given at the top of the page and although this is correct, it would have been clearer if the genotypes were given in the main body of the answer. All other mark points are present and clear.

Parent Phenotype Smooth, Purple Wrinkled, Yellow

Parent Genotype Aa Bb aa bb

Gametes AB Ab aB ab ab ab ab ab

F1 Genotype AaBb, Aabb, aaBb, aabb

F1 Phenotype Smooth Purple, Smooth Yellow, Wrinkled Purple, Wrinkled Yellow

Ratio 4 : 4 : 4 : 4

1 : 1 : 1 : 1

	AB	Ab	aB	ab
ab	AaBb	Aabb	aaBb	aabb
ab	AaBb	Aabb	aaBb	aabb
ab	AaBb	Aabb	aaBb	aabb
ab	AaBb	Aabb	aaBb	aabb

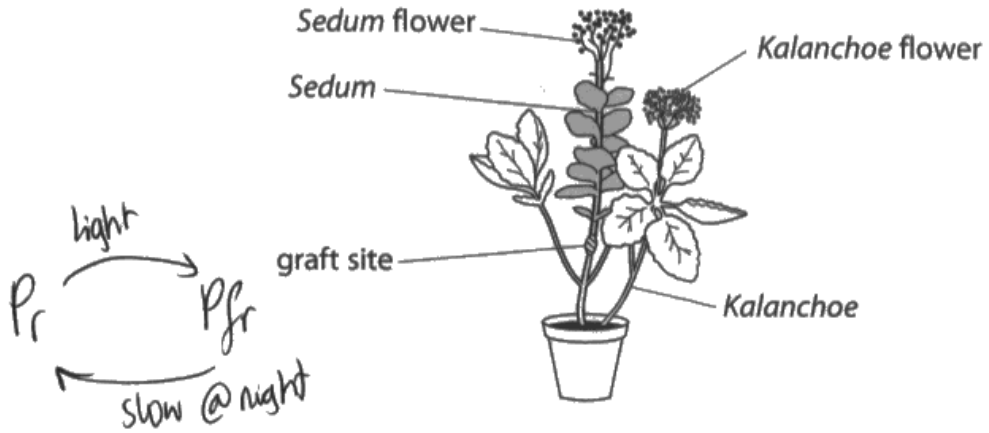
Answer 1/4

ResultsPlus
Examiner Comments

This answer gained all four marks. It is a good example of how to set out a cross clearly so that examiners can easily see the working.

Question 5 (b)

This question discriminated well. Less able candidates tended to gain one or two marks for simply describing the effect of different periods of light and dark on flowering in the two species of plant without offering any explanation linked to phytochrome or considering the second, grafting, experiment. The more able candidates fully explained the role of phytochrome, although candidates should understand how the light and dark periods change it from one form to another; many were confused as to whether P_{FR} or P_R is produced after light exposure. The best answers, of which there were a significant number, discussed how the second experiment demonstrated that some factors must be moved between the two plants to initiate flowering. Some outstanding answers were seen which showed off the high-level of knowledge that many candidates have developed. In future series, candidates should try to ensure that if they are presented with two sources of data that they comment on both and that they use full, A level detail.



Analyse the data to explain the effects of different light periods and far red light on flowering in *Kalanchoe* and *Sedum*.

(6)

Data suggests Kalanchoe is a short day plant, while Sedum is a long day plant. This is reflected by the first 2 rows, which show Kalanchoe flowering after longer periods of darkness, while Sedum flowering after longer periods of brightness. This is due to the fact that Pfr stimulates flowering in Sedum (as this builds up in light) and Pr stimulating flowering in Kalanchoe,

while Pr inhibits in Sedum and Pfr inhibits in Kalanchoe. This is also seen in the third row of the graph, the flash of light causes Pr to convert to Pfr which stimulates flowering in Sedum. The flash of far red light has the reverse effect in the final row, as it is the final flash of light that has the long lasting effect. Despite the flash of light, as far red light flash occurs after this has this effect as converts to Pr which stimulates the flowering in Kalanchoe but inhibits in Sedum. After the grafting, this allowed flow of chemical hormones from ~~the Sedum to the Kalanchoe~~ Kalanchoe to the Sedum, which allowed the 10 hours of light to cause the Sedum to flower, which wouldn't have happened if it had not been grafted onto a short day plant. The Sedum also shows some lateral bud growth, which the kalanchoe mostly an apical dominance

In conclusion, the final flash of light triggers the final response by this short and long day plant, while grafting allows for plants hormones to be transfered.

ResultsPlus
Examiner Comments

This is a very strong, level three answer which was awarded five marks. There is a clear description of the effect of light on the two plants and this is explained in terms of the conversion of phytochrome. The second experiment is explained, and the candidate suggests that some chemical substance must move from one plant to the other to initiate flowering.

In short day plants like Seelum, there were more in higher periods of darkness. This means more Pfr ~~light~~ far red light being converted to ~~red~~ far red light. This can be seen at the first piece of data. Second piece of data, Kalanchoe is a long day plant so is in higher periods of lightness. This means more ~~red~~ far red light is converted to red light red light is converted to far red light This explains why in the 3rd bar piece of data in the Seelum (Short day plant) there are is less long periods of light shown, by 16 hours. In the last piece of data, Kalanchoe, the long day plant, there is more far red light being shown on the graph, to indicate how light is being received by the plant.

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Examiner Comments

This is a level one answer which was awarded two marks. The answer is almost purely descriptive and does not explain the results in terms of phytochrome conversion.

The Kalanchoe plant is known as a short day plant as it does not flower in longer periods of light. The Sedum plant is known as a long day plant as it flowers when it is exposed to longer periods of light. Short day plants, such as Kalanchoe, ~~the~~ seem to flower in the presence of the phytochrome Pr as the exposure of the plant to far red light converts Pfr to Pr. This is shown in the fourth result where a flash of far red light causes flowering in the Kalanchoe. In long day plants, like ~~the~~ Sedum, they flower in the presence of phytochrome Pfr. The red light, usually present in the light, converts the Pr to Pfr and causes flowering. This is shown in the third result where a flash of light, which contains red light, causes flowering in Sedum.

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Examiner Comments

This is a level two answer that was awarded four marks. There are good, accurate descriptions of the effects of light on flowering and this is then explained by the activity of phytochrome. No real explanation of the second experiment is offered.

From the data, in the first block, it shows at 15 hours of light exposed kalanchoe doesn't flower but sedum does flower. This suggests kalanchoe is a short day plant and sedum is a long day plant. Sedum will flower as when exposed to more day light, which has red light, the pigment pr is converted into pfr. Pfr will allow flowering to occur. This is again shown by the second bar which has 10 hours of light. Kalanchoe, a short day plant will flower as the longer night means more pfr is converted into pr as the night/dark contains far red light although this conversion is slower. Pfr inhibits flowering in short day plants e.g kalanchoe. In the mid bar, the small flash of light in the dark period will mean red light can convert pr → pfr so the sedum will flower, but this will inhibit flowering in kalanchoe. In the last bar, when same amount of darkness is exposed of 14 hours, the small far red light will convert a lot of pfr → pr so kalanchoe can flower but even with sedum having a flash of light, as the far red light was after, this will have an effect and pr produced means it won't flower. In second experiment having more darkness allows sedum to flower as florigen produced in leaves allows flowering as a transcription factor-mRNA. this pigment must be found in the leaves then passes to stem so both flower as

(Total for Question 5 = 7 marks)

ResultsPlus
Examiner Comments

This is an excellent, level three answer which was awarded six marks. The candidate describes and explains the results of the first experiment thoroughly and goes on to give a strong explanation of the second experiment.

~~Kalanche~~ Kalanche requires ~~more~~ a smaller light period than seaum in order to produce flower meaning that sedum is a morning plant and kalanchoei is ~~an~~ a night plant. this is further supported where the experiment had a small period of light during the dark period which caused ~~the~~ a reset in the production of

ResultsPlus
Examiner Comments

This is a level one answer which was awarded one mark. The answer is purely descriptive and the description is very basic.

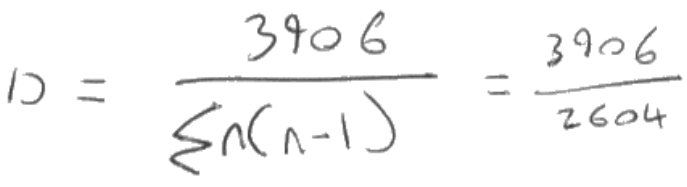
Question 6 (a) (i)

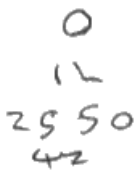
This question generated a surprisingly mixed quality of answers. Many candidates clearly understand how to calculate the index of diversity described in the specification, however a significant number of candidates seemed to be unfamiliar with the equation, or how to use it. Some candidates were confused as to what the sigma character means and there was confusion over whether N or n referred to the total number of species. It is important that candidates are fully familiar with the quantitative methods listed in the specification and understand the mathematical notation used.

(a) (i) Calculate the index of diversity for 1985 using the formula

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

(3)





Answer 1.5

ResultsPlus
Examiner Comments

This correct answer gained three marks. The candidate sets out their working clearly so that even if they had made a mistake in the final stages of the calculation, some credit would have been available.

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

(3)

1(1−1) = 0

4(4−1) = 12

51(51−1) = 2550

7(7−1) = 42

1 + 51 + 4 = 59

59 × 51 = 3422

59

2604

= 2604

= 0.022

$\frac{3422}{2604}$ = 1.314

= 1.3

Answer 0.022 1.314

ResultsPlus
Examiner Comments

This answer gained one mark for the correct calculation of 2604.

Question 6 (a) (ii)

Many candidates found this question surprisingly challenging. Just over half of the candidates were able to recognise that the index of diversity takes the number of individuals in each species into account and stronger candidates then went on to state that this is important because populations can vary. Many less able candidates simply stated that it was a more valid method, without explaining why, and / or confused it with other measures such as species richness. Candidates should also be careful with the vocabulary that they use; terms such as population, species richness and community are technical words with specific definitions.

(ii) Explain why using an index of diversity is a better measure of biodiversity than counting the number of species only.

(2)

Takes into account the size of each species because there might be large ~~numb~~ number of one species and small number of another species which will decrease diversity

ResultsPlus
Examiner Comments

This candidate gained both marks for correctly implying that the index of diversity takes account of the number of individuals and that these numbers can vary. The 'size of each species' is qualified later in the answer when the candidate refers to numbers.

Counting numbers of species does not represent how many of each species are present. Index of diversity takes into consideration the number of species as well as the number of members of each species.

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that index of diversity takes the number of individuals of each species into account. The candidate does not go on to explain that the numbers of individuals could vary.

Counting the number of species (2)

Because it doesn't tell you. Because using an index shows how many different number of each species are in a population, it is an accurate direct count of the biodiversity, whereas just counting species number is very vague as some species have a much higher population than others in an ecosystem.

ResultsPlus
Examiner Comments

This is a good answer that gained both marks. The candidate explains that the number of each species can vary.

ResultsPlus
Examiner Tip

Always try to think how each mark point will be awarded. If it is a two mark, 'explain,' question, try to make sure that your answer is structured on the lines of 'it is *this* **because of** *this*.'

Question 6 (a) (iii)

This question produced a wide range of responses and discriminated well. Less able candidates often gained one or two marks for correctly recognising that the index of diversity decreased, and that all the birds are now extinct, but often did not spot any of the other patterns, such as the Marian crow increase. More discerning candidates often recognised the different rates of extinction, or noted that some bird species increased in population as other birds went extinct. When analysing complex data patterns, it is good practice to note the overall trends and then look for others which do not fit the overall trend, or are less obvious.

(iii) Comment on the effects of introducing the brown tree snake to Guam.

(4)

The introduction of the brown tree snake introduced a new predator of the birds of Guam. Initially, the index of biodiversity increased as there was a reduction of competition for resources for some birds as others had been eaten by the snake. However, the index then fell because the fewer birds, the higher chance of the snake eating them until eventually there were no birds seen in those areas.

ResultsPlus
Examiner Comments

This was a good answer which gained three marks. The candidate clearly identifies the trend and the index of diversity decreases and the birds become extinct. They also give an explanation for the increase in some bird species due to decrease in competition.

ResultsPlus
Examiner Tip

Always look for general data patterns first and then look more closely to see less obvious patterns or outlying data points.

The brown tree snake has hugely reduced the biodiversity of birds in Guam. By 1986 no birds were on the island. Some species increased between 1982 and 1983 such as the white-throated ground dove and the micronesian kingfisher. The bridled white-eye, [illegible] and the [illegible] fantail and the guam flycatcher and manan (mot dove became extinct on Guam first. The brown tree snake used these birds as prey and hence their population is decreased as they cannot reproduce. The birds which become extinct last, the micronesian starling, manan crow, and kingfisher were the best adapted to surviving predation by the snakes, in fact the manan crow saw an increase in number all the way until 1983 when they became prey for the snake. Their ability to survive predation until 1983 meant they could reproduce and expand their gene pool.

ResultsPlus
Examiner Comments

This is a very strong answer which gained all four marks. The candidate clearly describes the reduction in biodiversity and the fact that the species became extinct. They also, correctly, describe the changes in population to other species such as the Marian crow and strongly imply that the birds go extinct at different times.

By 1986, the number of all bird species had reached zero. The introduction of brown tree snake to Guam was the selection pressure and the snake preyed upon all the species of bird. This meant the birds could not reproduce effectively and the population of the bird reached zero as a result.

ResultsPlus
Examiner Comments

This answer gained one mark for describing the extinction of all bird species. There is very little detail as to the changes in population of other species.

Question 6 (b) (i)

Most candidates were able to gain at least one mark on this question. The most common reasons provided to explain the restricted diversity of plants were reduced seed distribution, pollination, and the increase in herbivorous insects. A few candidates only gave one reason; candidates should be careful to ascertain what the question is asking them for. A few candidates misread the question and suggested that the loss of birds would lead to an increase in plant diversity.

(b) The biodiversity of plant species on Guam has decreased.

(i) Give two reasons why changes in the number of bird species have led to this decrease in biodiversity of plant species.

(2)

- decrease in birds mean plants can not be pollinated by birds so less fertilisation of plants means they cannot reproduce.
- less birds means fewer seeds are brought to island by the birds for example in their faeces so no longer any gene flow of from other species of plants from mainland to island.

ResultsPlus
Examiner Comments

This is a good answer which gained two marks for the ideas relating to reduced pollination and seed dispersal.

Birds kill mungs such as insects for nutrients. When there is less birds there are more insects and insects feed on plants so more plants get digested so its biodiversity decreases.

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that the birds may consume herbivorous insects. The candidate has only given one reason so only one mark is available.

Question 6 (b) (ii)

This question discriminated well, with strong candidates often gaining at least three marks, whilst less able candidates typically gained one. Most candidates recognised that seed banks require a wide variety of seeds to ensure genetic diversity. Less able candidates often gave vague references to storage methods. Strong candidates avoided giving vague references to storage methods and fully explained how the seeds are maintained in a seed bank in cold, dry and airtight containers. A significant number of candidates correctly explained how seeds are often X-rayed or tested for viability before or at various points during the storage.

(ii) Scientists are using seed banks to conserve the biodiversity of plants.

Describe how seed banks are used as a method of conservation.

added to the soil. so more intraspecific competition between plants

Seeds are gathered and are ~~ex~~ X-rayed to see if the seeds have embryos (check if the seed will germinated - viability). The seeds are then stored in -20°C rooms underground & with no humidity. Very couple of month the seeds are checked for viability.

(Total for Question 6 = 15 marks)

ResultsPlus
Examiner Comments

This is a very strong answer which gained three marks. The candidate has clearly stated that seeds are X-rayed and then stored at -20 °C in dry conditions.

seed banks are used to replicate seeds to increase and therefore conserve their biodiversity
They are often set up in labs or in greenhouses and are isolated * so they can grow and germinate away from any biotic factors like disease or abiotic factors such as too high temperatures that may affect their growth The seeds are regulated regularly and monitered to ensure their biodiversity is kept.

ResultsPlus
Examiner Comments

This answer did not gain any credit. The statements: 'keeping them away from high temperatures' and 'regularly monitoring' were too vague to gain the marks; it was considered to be not quite enough for low temperature was not enough for checking viability. The use of precise language is very important.

seed banks are efficient way of conserving seeds. Firstly, seeds are taken from the plants, washed, dried and tested under X-rays. This test checks if the embryo are active. Then, ~~they~~ seeds are stored under ~~in~~ condition -40°C ~ -20°C so that seeds can still germinate ~~in~~ ~~few~~ many years later. ~~This~~ Seeds are small, so it does not take a lot of space however the field that stores seeds is takes a lot of space.

ResultsPlus
Examiner Comments

This is a very good answer which gained three marks. The candidate explains the use of low temperatures and the role of X-raying to check viability. They also go on to explain that many seeds can be stored to increase biodiversity.

Question 7 (a) (iii)

This question was found to be challenging by many candidates, although stronger candidates did give well-thought-out answers which fully linked the function of glycogen to its structure. A surprising number of candidates confused glycogen with cellulose, suggesting that it has beta glucose as the monomer and a linear structure. Many candidates did not fully link the structure of glycogen with its properties and often gave a description rather than an explanation. Where candidates did score well, it was typically for linking the branched structure of glycogen with its rapid hydrolysis and linking its insolubility with osmotic effects. There was some confusion over the roles of the 1,4 and 1,6 bonds - candidates should be careful to refer to correct facts in their answers.

(iii) Explain how the structure of glycogen is related to its function.

(3)

- glycogen is a branched, compact molecule. and
- Being branched allows for quick build up, breakdown of the molecule, ~~idea as~~ which is ideal as it is an energy store.
- glycogen is compact meaning it is ideal for storage of energy.

ResultsPlus
Examiner Comments

This is a good answer which gained two marks. The candidate clearly links the branching with rapid breakdown and the compactness with storage.

Glycogen is branched, has 1-4 and 1-6 glycosidic bonds, increased number of branches for increased storage. Branched so takes up little space, can store a lot in a small area (/ unit volume).

ResultsPlus
Examiner Comments

This answer gained no marks. The candidate does mention the branched structure and storage but has linked them incorrectly.

ResultsPlus
Examiner Tip

It is important to link structure to correct function on questions that ask for explanations of structures, rather than descriptions.

and 1,6 (3)

Glycogen has 1,4 ✓ glycosidic bonds, but ~~has~~ has more 1,6 glycosidic bonds. The structure is branched, meaning the bonds can be easily broken down by hydrolysis to release glucose/ energy. This ~~re~~ relates to its function because glucose ~~and~~/energy can be released rapidly for organisms that have high metabolic demands, like animals. This is explained why it is given the name animal starch.

ResultsPlus
Examiner Comments

This answer gained one mark for the linking of the branches with rapid hydrolysis. Although the candidate mentions 1,4 bonds and glucose, the two points are not sufficiently linked together to gain mark point one.

– has 1, 4 glycosidic bonds which leads to a straight chain of glucose molecules, but also has 1, 6 glycosidic bonds allowing branching of the molecule. This allows the molecule to become compact and allows easy storage. As a molecule used for rapid break down into glucose, it has terminal glycosidic bonds at the base of the 1, 6 bond that allows quick breakdown for access to glucose.

ResultsPlus
Examiner Comments

This is an excellent answer which gains all three marks. The candidate clearly states that glycogen has 1,4 glycosidic bonds between glucoses, is compact for storage and has 1,6 bonds for rapid breakdown.

Question 7 (b)

Strong candidates gave excellent answers which fully explained the roles of adrenaline receptors in the membrane of cells, secondary messengers, and how they activate enzymes. Some candidates confused the action of adrenaline with the action of oestrogen, referring to the diffusion of adrenaline across the membrane and its effect on transcription factors. The specification requires candidates to understand the two main mechanisms of cell signalling; candidates should be fully familiar with both. A minority of candidates misunderstood the emphasis of the question and referred to the roles of insulin and glucagon in blood glucose regulation. Many candidates referred to adrenaline binding to cells, with no mention of receptors, or did not mention the location of the receptors. Precision in answers is extremely important.

(b) The hormone adrenaline is unable to pass through cell membranes.

When liver and muscle cells are exposed to adrenaline, the enzyme glycogen phosphorylase breaks down glycogen in these cells.

Describe how adrenaline causes liver cells to increase the concentration of glucose in the blood.

(3)

Adrenaline binds to receptors on the liver cells surface, that triggers the release of the secondary messenger cAMP. This messenger is then able to amplify the response within the cell and initiate the increase in blood glucose concentration.

ResultsPlus
Examiner Comments

This answer gained two marks for correctly stating that adrenaline binds to surface receptors and this stimulates cAMP production.

Adrenaline is released into the blood and is detected by the brain in the medulla oblongata which increases the heart rate as more impulses are sent to the SAN and releases glucose as more respiration is required to occur as the heart rate increases.

ResultsPlus
Examiner Comments

This answer gained no marks. It is an example of where a candidate has misinterpreted the emphasis of a question by identifying the key words but not the context. Candidates should read all parts of questions very carefully.

Adrenaline binds to the receptor on the liver cell. It causes a chain reaction where a G-protein is activated, then AC is activated. AC uses ATP to form cAMP, cAMP then goes on to ~~acts~~ act as a transcription factor. It ~~can~~ activates protein kinases ~~that~~ which aid in the transport proteins needed for the ~~prod~~ production of glycogen phosphorylase.

ResultsPlus
Examiner Comments

This is an excellent answer. The candidate clearly describes how adrenaline binds to membrane receptors, stimulating cAMP production which then activates phosphorylase.

Question 7 (c) (i)

Many candidates found this question very challenging and a significant number seemed to be unsure how to use the Hardy-Weinberg equation. When carrying out Hardy-Weinberg calculations, candidates should write down all their working and make it clear how they determine allele frequencies. A significant number of candidates did not give any working or wrote down working in a very confused manner. Some candidates correctly determined the frequency of heterozygous individuals but did not then use this to predict the number of individuals. Where candidates understood how to use the Hardy-Weinberg equation, they often gained all four marks.

(c) The genetic condition Hers disease is caused by a recessive allele of the glycogen phosphorylase gene.

In an isolated population of 1400 people in the USA, 15 people have Hers disease.

(i) Calculate the number of heterozygous individuals in this population.

Use the Hardy-Weinberg equation

homo dom / hetero / homo recess

$p^2 + 2pq + q^2 = 1$

$2pq = q^2$

(4)

$\frac{15}{1400} = 0.010714$

$q = 0.010714$

$q^2 = \sqrt{0.010714} = 0.10351$

$p + q = 1$

so $p = 1 - 0.010714 = 0.989286$

$p^2 = \sqrt{0.989286} = 0.99463$

Answer 0.09814

$0.99463 + 0.10351(-1) = 2pq$

$1.09814 - 1 = 0.09814$

ResultsPlus
Examiner Comments

This answer gained one mark for the correct calculation of q^2. The candidate then wrongly substituted this value into the equation.

$1400^2 + 2 \times 1400 \times 15 + 15^2 = 1$

~~$1400^2 + 2 \times 1400 \times 15 + 15^2 = 1$~~

$p^2 + p + q^2 + q = 2 + 1$

Answer .....

ResultsPlus
Examiner Comments

This is an example of a candidate appearing to be unaware of how to use the Hardy-Weinberg equation. Candidates should ensure that they are familiar with all the quantitative methods in the specification.

$q^2 = 15$

$q = \sqrt{15}$

$p + q = 1$

$p + \sqrt{15} = 1$

$p = 1 - \sqrt{15}$

$p + q = 1$

$p = 1 - q$

$p = 1 - \sqrt{\frac{3}{260}} = 0.89649$

$q^2 = \frac{15}{1400} = \frac{3}{260}$

$q = \sqrt{\frac{3}{260}} = 0.10351$

$2pq = 2 \times 0.89649 \times 0.10351$

$= 0.18559$

$0.18559 \times 1400 = 260$

Answer 260

ResultsPlus
Examiner Comments

This answer gained all four marks. The working is fairly clear so that some credit would be available if the final answer was incorrect.

$q^2 = \frac{15}{1400} = 0.01$

$p^2 + 2pq + q^2 = 1$

$0.8965^2 + 2pq + 0.01 = 1$

$p + q = 1$

$2pq = 2 \times 0.01 \times 0.8965 = 0.1856 = 0.19$

$p + \frac{\sqrt{15}}{1400} = 1$

$p = 0.8965$

Answer 0.19

ResultsPlus
Examiner Comments

This is a good attempt which gained three marks. The correct frequency for 2pq was calculated (0.19) but the candidate did not then use this to determine the number of individuals who were heterozygous.

Question 7 (c) (ii)

Most candidates were able to gain at least one mark for this question and typically recognised that the gene pool of the population would be small or have undergone a genetic bottleneck effect. Strong candidates explained how this increased the probability of two heterozygous individuals having children together or correctly stated that a founder effect had occurred. Some candidates simply restated the question, writing that there would be more individuals with the syndrome without explaining why. Candidates should ensure that they do not restate questions.

(ii) The frequency of Hers disease in most human populations is 1 in 40 000.

Explain why the frequency of Hers disease is higher in the isolated population.

(2)

In an isolated population, the gene pool is reduced due to interbreeding occuring. This means there is an increased ~~odd~~ chance of 2 recessive alleles joining to cause Hers disease.

ResultsPlus
Examiner Comments

This is a good answer which gained both marks. The candidate clearly states that the gene pool is reduced and that this increases the chance of two recessive alleles being inherited.

They are isolated therefore their gene pool is restricted and significantly smaller. The chances two recessive alleles which cause Hers disease is much more likely. The most human population have a large gene pool thus the disease is less ~~common~~ frequent.

ResultsPlus
Examiner Comments

This is a good answer that gained two marks. The candidate clearly explains how a reduced gene pool leads to increased probability of two heterozygous parents having children.

Question 8 (a) (i)

This question was found to be surprisingly challenging for many candidates. Stronger candidates gave excellent definitions of ecosystems; considering both the biotic and abiotic factors within them. Many candidates gave vague definitions that referred to habitats rather than environmental factors, or referred to plants and animals rather than organisms and species. Candidates should take care when giving formal definitions of defined terms to be accurate and precise with their wording.

8 The island of Surtsey was formed by a volcanic eruption in the Atlantic Ocean in 1965.

The photographs show the formation of Surtsey in 1965 and part of the island in 2018.



volcanocafe.files.wordpress.com



vulkaner.no

Scientists have been studying the development of ecosystems on this island since its formation.

(a) (i) State what is meant by the term ecosystem.

(1)

The species that live ~~~~ together, benefiting from each other.

ResultsPlus
Examiner Comments

This is an example of a vague answer which gained no credit. The candidate does not refer to the environment at all.

(a) (i) State what is meant by the term ecosystem.

(1)

a place

~~the environment~~ in which organisms ~~and~~ interact with each other and the environment.

ResultsPlus
Examiner Comments

This is a good answer which gained the mark. The candidate clearly states that an ecosystem is the combination of organisms and the environment.

An ecosystem is a system of flora and fauna.

ResultsPlus
Examiner Comments

This answer gained no marks as there is no mention of the environment.

the relationships between all living (biotic) and non living organisms of a system (abiotic) area factors.

ResultsPlus
Examiner Comments

This is a very good answer which gained the mark. The candidate clearly states that ecosystems are a combination of the abiotic and biotic factors.

Question 8 (a) (ii)

This question was well answered by many candidates with a significant number gaining four or five marks. Most candidates clearly understand the stages of succession and how the organisms interact with each other to change habitats. Some outstanding accounts were seen, with full explanations of all the seral stages involved; how organisms opened up more niches, and how competition could have affected biodiversity. Generally, candidates used terminology such as succession, seral stages, climax community and pioneer species with confidence. Candidates lost marks for assuming that the succession was secondary succession, rather than primary, and frequently misunderstood the term 'pioneer species', using it to refer to later arriving species.

(ii) Explain how ecosystems have developed on Surtsey since 1965. (5)

This is primary succession, where the ~~species~~ communities colonising the area change over time. Volcanic eruption leads to lots of organic rocks forming a surface. ~~Pioneer~~ species e.g. fungus/lichen can penetrate the rocks, into small grains. These ~~organisms~~ grains form humus and help form soil. Over time the roots of the pioneer species break down and ~~help it~~ continue to the soil so it is stronger and can ~~hold~~ hold more nutrients and water. This means more herbaceous species can colonise the ~~area~~ area as seen in the photo. They use more water & nutrients and are taller. This increases plant diversity, so more niches are supported so more animals can fill them, increasing animal diversity. This means that a climax community is formed, which is a self ~~sustained~~ sustaining community that is at its most productive and has a relatively constant biodiversity and has 1 dominant species. This allows for a new ecosystem to form over the course of the 53 years. Next climax is formed.

ResultsPlus
Examiner Comments

This is an excellent answer which gained all five marks. The candidate clearly explains the process of primary succession in detail. Correct explanations of the roles of pioneer species in changing the habitat are given and scientific, technical vocabulary is used throughout. All mark points are evident.

The volcanic rock began as inorganic and bare. Overtime, birds rested and defaecated, algae and semi-aquatic plants grew and died, forming soil, the first part of primary succession. Birds also brought seeds, using their faeces as a vector and also, perhaps insects or parasites. As soil formed, plants began to grow, reproduce and die. Bacteria, carried over also helped in nutrient cycling. All allowing plants to grow. Hence the image with birds and plants.

ResultsPlus
Examiner Comments

This answer gained three marks. The candidate describes the process of primary succession, and refers to the production of soil and increased minerals which enables other plant species to grow.

After the island of Surtsey was formed in 1965, primary succession occurred as there were no previous ecosystems or organisms on the island before. Therefore organisms arrived by sea, air or on birds to inhabit the island. Those organisms would have reproduced, creating a predator-prey relationship and eventually forming an a food web. Some organisms may have died due to natural selection, and eventually each species would have adapted to their ~~niet neiche~~ niche, forming an ecosystem

ResultsPlus
Examiner Comments

This is an answer that gained one mark for the idea of primary succession. The candidate does mention the arrival of other species but does not really explain how the habitat is affected by them.

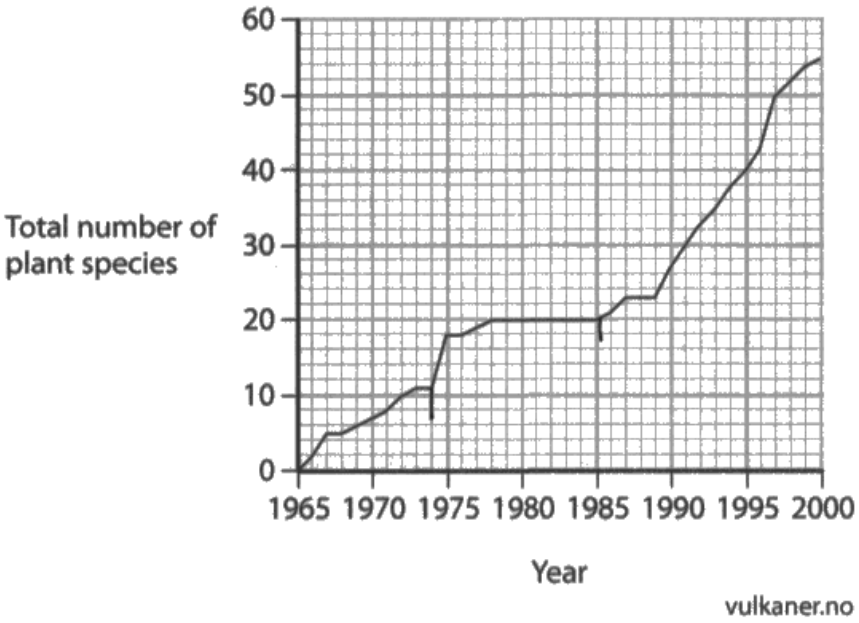
Question 8 (b)

This question discriminated well. Some candidates found commenting on the data challenging; often, they did not make comments beyond stating that the number of plant species had risen after the arrival of both bird species. Some candidates were not precise enough when using dates; for example, many suggested wrong dates for the period of time when the number of plant species did not increase. Candidates should be very careful to ensure accuracy when citing data from graphs and diagrams. Strong answers included good suggestions for the reasons that the number of plant species rose, often referring to the movement of seeds, increased soil fertility and loss of herbivorous organisms. A few candidates misinterpreted the data and suggested that the arrival of the birds caused a decrease in the number of plant species.

(b) The scientists recorded the number of different plant species on the island each year from 1965 to 2000.

The number of new plant species present at each survey was recorded.

The graph shows the total number of plant species that have been found on the island.



A few groups of one species of seagull arrived on the island in 1974.

In 1985 a large group of a different species of seagull, the black-backed gull, arrived on the island.

Comment on the effects of these two species of seagull on the number of plant species.

(4)

(when the seagulls arrived,)

In both 1985 and 1974 there was a sharp increase in the number of plant species. This increase could be due to many reasons. Firstly the seagulls may have been carrying seeds on their feathers because some plants disperse their seeds via animals. New seeds would allow new plants to grow and reproduce. The seagulls may also be feeding on pests that eat plants. When the seagulls die or egest/excrete waste, the mineral and nutrient content of the soil increases. Seagulls increase biodiversity and increase the humus content of the soil upon death. The seagulls in 1974 caused a sharper increase in plant species than 1985.

ResultsPlus
Examiner Comments

This is an excellent answer which gained all four marks. The candidate describes the increases in number of plant species after arrival of the birds and goes on to suggest that the birds would have brought seeds, minerals and eaten pests.

as the two species of seagull were introduced the number of plant species increased overall. this is because seagulls donot feed on the plants so the plants did not become extincted & were not endangered. when seagulls died they decomposed & provided the right nutrients such as nitrates in the soil for the plants to grow.

(Total for Question 8 = 10 marks)

ResultsPlus
Examiner Comments

This is a good answer which gained two marks for recognising the increase in the number of plant species after the birds arrived, suggesting that this is due to increased nutrient composition of the soil.

Question 9 (b) (i)

Most candidates were able to correctly rearrange the equation to derive the correct answer. A minority of candidates carried out a division rather than a multiplication.

Question 9 (b) (ii)

This question generated a very good range of answers and the examiners commented on how well the candidates had understood the data. Most candidates were able to recognise that a reduced partial pressure of oxygen in the blood would lead to a lowered Carrico index and many went on to explain this by referring to the reduced alveolar expansion and resultant reduction in surface area. Fewer candidates also discussed the effect of reduced air intake in the lungs. Less detailed answers often gained one mark for stating that the partial pressure of oxygen in the blood would be lowered without offering an explanation.

(ii) Explain why the Carrico index for the baby with ARDS is lower than the Carrico index for the unaffected baby.

(4)

In babies with ARDS the partial pressure of oxygen in arterial blood is lower as less oxygen can be taken in during lung inhalation this mean the lung efficiently is lower as less oxygen is transported into the blood

ResultsPlus
Examiner Comments

This answer gained two marks for correctly stating that less air, or oxygen, is inhaled and the partial pressure of oxygen in blood will be lower. There is no mention of reduced surface area.

The efficiency of the lungs is lower in the ARDS baby because the alveoli cannot expand sufficienty and therefore diffusion of oxygen from inhaled air to alveolar blood in the capillaries is low. This is because the surface area of the alveoli is low when not fully expanded so not enough O_2 enters the blod.

ResultsPlus
Examiner Comments

This strong answer gained three marks. The candidate states that the alveoli do not expand fully, have a reduced surface area and so there is less diffusion of oxygen into the blood. There is no mention of reduced inhalation of air.

Question 9 (c)

Most candidates were able to interpret the graphs well and recognised that the combination of A and B increased both the Carrico index and the expansion of the alveoli. Many also went on to compare this to the natural surfactant and link the increased alveolar expansion with the increased Carrico index, often describing the positive correlation between them. Stronger answers frequently discussed the validity of an animal model and whether the findings could be extrapolated to human babies, and many stated that the sample size was small. Some candidates also compared the Carrico index for normal babies with the data from the rabbit experiments to decide whether the drugs would produce the same index as unaffected babies. Less detailed answers tended to only include the data patterns seen in one or both graphs without comparison or explantion.

Analyse the data to explain the potential use of these two compounds to treat ARDS in human babies.

(6)

The data shows that the combination of compounds A and B caused the most significant improvement in both the Carrico index and ability of the alveoli to expand ; in the rabbits with ARDS, as it produced the greatest change ~~in~~ at a ~~the~~ higher ~~ther~~ rate than the other treatments. The natural surfactant and the ~~treat~~ compound B treatments also showed similar improvements to ~~the~~ each other for both the Carrico index and the ability of the alveoli to expand, which was an approximate difference of 53 kPa and 50kPa for Carrico index after 120 mins in the use of compound B and the natural surfactant (control) respectively. Compound A is shown to have a much lesser effect on both of these two factors, as the Carrico index ~~is at around~~ has a difference of around 46 kPa (compared to compounds A and B's difference of 60 kPa) over 120 minutes, which suggests that treatment using this compound only would be the least effective for ARDS. To treat human babies, further investigations would need to be done to test the safety of the treatments on humans, but ~~th~~ treatment with compounds A and B would seem like the most effective from this ~~exp~~ investigation.

ResultsPlus
Examiner Comments

This is an excellent, level three answer which gained five marks. The candidate clearly describes and explains both sets of data, linking them together. They make a clear comparison with the control and go on to suggest that more trials may be needed as rabbits may not be the same as humans.

The use of both compounds A & B are one most effective in treating ARDS. This is because 15 mins after administration the effect on the Carrio index & expansion continues to increase while the other compounds begin leveling off. Graph 1 show the Carrio index remains fairly stable & the highest between 64 & 67. & while Graph 2 shows that both compounds A & B have the highest ability to expand, at 0.48 at 120 mins, compared to 0.44 for just compound B. Therefore the use of both compound A & B will increase the effectiveness of lungs in babies by allowing the alveli to expand & increase the surface area for gas exchange. This can treat babies with ARDS.

(Total for Question 9 = 13 marks)

TOTAL FOR PAPER = 90 MARKS

ResultsPlus
Examiner Comments

This is a level one answer which gained two marks. The candidate compares the two drugs but does not explain their effect or compare against the control. No discussion of animal model compared to humans is made.

Both graphs show that compound B had a larger effect than compound A on ~~the~~ treating ARDS in human babies. compound B expands the alveoli at a greater rate than A does and also gives a larger carnico index, meaning the babies are ~~recieved~~ recieving more oxygen in the arterial blood. When both compound A + B are used together, there is a great increase in the ability of the alveoli to expand as well as the carnico index value, showing that using compound A + B together are most effective. The natural surfactant works roughly ~~the~~ ~~sa~~ in the same way as compound B does. Using compound A alone gives the smallest effect on ~~both~~ treating ~~baba~~ ARDS in human babies both by not causing a huge increase in ~~carnico~~ carnico index and not having the ability to expand the alveoli. However, using compounds A + B together would help treat ~~AD~~ ARDS in human babies a lot more ~~easier~~ quicker and more efficiently.

ResultsPlus
Examiner Comments

This is a good, level two answer that describes and explains both sets of data. The candidate has correctly compared the data with the control and attempted an explanation which they have supported with detail. No mention of sample size or validity of the animal model is made. Four marks were awarded.

From both of the graphs, it is visable that the combination of both compounds A & B works best to increase the cannico index and increases the ability of alveoli to expand. We can also detect that natural surfactant works as well as the compound B.

These two compounds can be combined to treat ARDS in human babies, through increasing the oxygen uptake by haemoglobin in the blood when it is compared to the oxygen inhaled. More of the oxygen inhaled can be successfuly used and transported around the body.

Also, the two compounds combined result in the alveoli being able to expand more, which increases it's surface area making it more suitable for it's function. More oxygen can ~~be~~ enter alveoli which means more oxygen can be sufficiently diffused into capillaries and be used around the body eg. in oxidative phosphorylation.

ResultsPlus
Examiner Comments

This is a level two answer that was awarded three marks. A thorough description of the data is given but only a limited explanation of how increasing surface area increases uptake of oxygen. A limited comparison is made with the control and no mention of the validity of using the data to support use on humans is made.

Paper Summary

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

- Be familiar with all the command words. The most commonly used words are 'describe' and 'explain' but there are many others which require different styles of answers.
- Show all your thought processes in answers.
- Be familiar with all quantitative skills listed in the specification, such as Hardy-Weinberg, and index of diversity.
- Write legible answers which are well spaced out.
- Approach data analysis questions with confidence.
- When analysing unfamiliar data, identify and describe more obvious patterns first and then look for other patterns.
- Use precise, accurate terminology.

Grade Boundaries

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

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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