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GCE Biology 9BN0 01

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Introduction

This is the third examination of the new reformed A level for this unit. This is now a linear assessment, with approximately half of the marks in this paper allocated to topics from year 1 of the course.

The type of question in this paper requires a greater application of knowledge and understanding the qualitative and quantitative data provided than in previous specifications. There are also two 6 mark questions which require candidates to write lengthy responses to convey their ability to produce sustained arguments or linkages between data and biologocal knowledge.

There were some very good answers, showing a depth and breadth of knowledge and understanding, especially of the different types of screening for genetic disorders. Answers which required the application of core practicals, however, often showed a lack of detail, especially those in the first year of the course.

Successful candidates:

- had revised all of the year 1 topics as well as topics 5 and 6
- thoroughly revised all of the core practicals, including those from year 1 of the course
- had learned how to interpret all of the command words, including more challenging examples, such as deduce and disuss
- included all of the data in their responses to questions which asked for an analysis of data
- read through the introductory material for each question and answered within the context set
- included specific, relevant details in their answers
- worked through calculations in a logical sequence and made measurements with the required degree of accuracy
- demonstrated the ability to convert units and orders of magnitude.

Less successful candidates:

- had gaps in their revision
- did not answer the questions using the context given
- missed vital steps in core practicals, or failed to put them into the context given
- did not understand how to interpret the command words
- recited learned responses from previous questions, irrespective of the context
- wrote vague, generic answers which lacked vital details.

Implications for future teaching, learning and exam preparation: revisit year 1 topics as year 2 topics are taught in order to develop the links required for a more thorough understanding of the more applied topics. Exam preparation should involve reinforcement of the new command words and examples of their use. As this is the third exam in the series, past papers are avilable to give candidates examples of the type of question and the responses expected. Candidates should be encouraged to use comparative terms where appropriate, e.g. more, increase, faster.

Question 1 (b)

This question is concerned with the effects of an increase in carbon dioxide concentration on the growth of plants. The command word is ''explain'', requiring an element of reasoning for full marks. There were many good answers but candidates lost marks by failing to give a comparative statement. An **increase** in the production of glucose and an **increase** in the rate of growth were required. Many candidates showed an understanding of the fixation of carbon dioxide to GALP, but few referred to an increased **rate** of growth.

(b) In some commercial glasshouses, the concentration of carbon dioxide in the atmosphere is increased.

Explain why this increase in carbon dioxide concentration affects the growth of plants in glasshouses.

(3)

- Carbon dioxide is a limiting factor in photosynthesis.
- It is incorporated into RuBP to make GP and then GALP.
- Increasing carbon dioxide will increase rate of fixation which means there will be an increase in ~~biomass~~. glucose molecules produced which are used as biomass.

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Examiner Comments

This is a clear response that gains 3/3 marks. Carbon dioxide is described as a limiting factor, followed by a description of carbon fixation to produce GP and GALP. This is then linked to an increase in glucose production.

ResultsPlus
Examiner Tip

Remember to include comparative statements in your answer if they appear in the stem of the question.

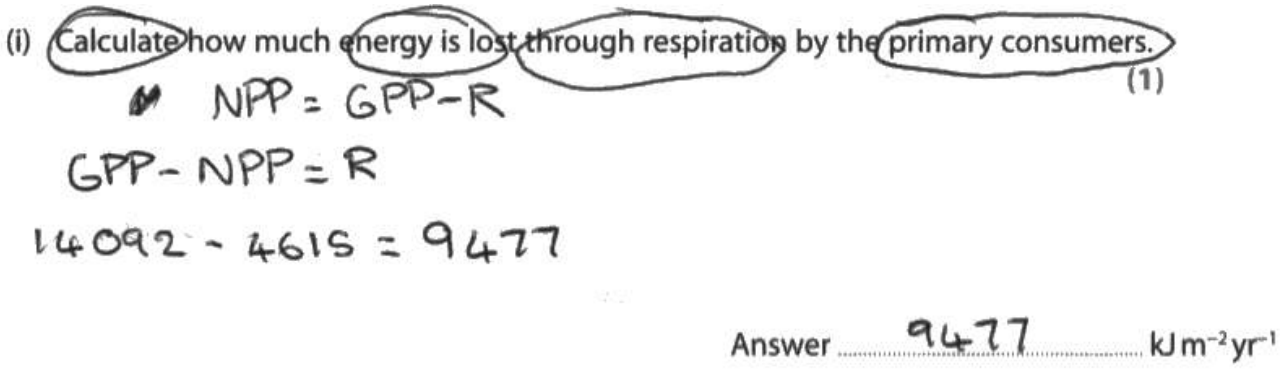
CO_2 is a limiting factor of photosynthesis - 6 CO_2 is combined with 6 ribulose bisphosphate catalysed by ribulose bisphosphate carboxylase which forms an unstable 6C compound which breaks down to 12 glycerate - 3- phosphate. Then with the addition of 12 NADP and 12 ATP it forms glyceraldehyde - 3- phosphate (GALP). 2/2 GALP form (hexose) glucose which is used by plants for growth - synthesis of cellulose, amino and nucleic acids all needed for growth. By increasing CO_2 concentration CO_2 is no longer a limiting factor and it can be incorporated into organic molecules faster therefore increasing rate of growth.

ResultsPlus
Examiner Comments

This response gains 3/3 for stating that carbon dioxide is a limiting factor and then giving a clear description of carbon fixation to produce GALP. This is linked to an increase in the rate of growth. There is no mark for the synthesis of glucose from GALP because there is no reference to an increase.

Question 2 (a) (i)

This question was a simple calculation asking candidates to calculate the energy lost through respiration by the primary consumers. The aim was to test candidates' knowledge of the relationship between Gross Primary Production, Net Primary Production and Respiration. Many candidates were able to answer this successfully.


(i) Calculate how much energy is lost through respiration by the primary consumers.
(1)

NPP = GPP-R

GPP - NPP = R

14092 - 4615 = 9477

Answer 9477 kJ m^{-2} yr^{-1}

ResultsPlus
Examiner Comments

The equation GPP-NPP=R is given and the calculation has been carried out correctly. It gains 1/1 marks.

Question 2 (a) (ii)

This question is looking at energy flow through an ecosystem in a state park in Florida.

This is a calculation question, looking at the efficiency of energy transfer between primary consumers and secondary consumers by selecting the correct data from the table. The answer was expected to be given to 1 decimal point as this is the same as the other values in the table.

(ii) The table gives details of energy transfers at the different trophic levels.

Trophic level	Energy fixed as biomass / kJ m^{-2} yr^{-1}	Transfer efficiency (%)
Producers	31 874	
Primary consumers	4615	14.5
Secondary consumers	464	
Tertiary consumers	21	4.5

Calculate the efficiency of energy transfer between primary consumers and secondary consumers.

(1)

$\frac{464}{4615} \times 100 = 10.05$

10.05 %

ResultsPlus
Examiner Comments

This answer scored 0/1 as the number of decimal places were greater than those in the table.

ResultsPlus
Examiner Tip

Remember to consider the appropriate number of decimal places in your answer. It is not possible to be more accurate than the values you were given.

10.1 %

ResultsPlus
Examiner Comments

This is a correct answer, gaining 1/1.

Question 2 (b)

This question asks candidates to explain what happens to light energy that is not converted to GPP in plants. There were some good answers, however, some candidates gave a general explanation of the energy loss at each trophic level in the ecosystem, missing out the detailed explantion required to answer the question and showing a lack of understanding of the term GPP. Most candidates were able to explain that some of the light is reflected and some is the wrong wavelength. Many lost a mark because, although they stated it was transmitted through the leaf, they did not explain that it missed the chloroplast.

(b) Explain why the value for GPP is lower than the light energy available to the ecosystem.
(3)

Gross primary productivity (GPP) is a measure of how much of the available energy is taken in. The GPP value is lower than the total amount of available energy because ~~the~~ not all the light energy is absorbed by the chloroplasts; some may pass through the leaves or be reflected, some may not be of a suitable wavelength to be absorbed by the photosystems in the thylakoid membrane, etc. The GPP is the average as well so it includes vegetation on at ground level which is partially blocked from sunlight by the taller trees.

ResultsPlus
Examiner Comments

This response gains 3/3. They explain that the light which is not absorbed by the chloroplasts will pass through the leaf, some of the light is reflected and some is not of a suitable wavelength.

The GPP value is lower than the available light energy as not all energy is ~~used~~ transfered to the producers. This may be because the sunlight hits a part of the plant/producer which does not photosynthesise, such as tree bark. Some light energy passes straight through the leaves and some is reflected off. This means not all available light energy is used by the producer and it is left in the previous trophic level.

ResultsPlus
Examiner Comments

This response gains 2/3, for stating that some of the light falls on a part of the plant which does not photosynthesise, such as the bark, and some is reflected. There is no mark for stating that the light passes through the leaf because it is not linked to missing the chloroplasts.

ResultsPlus
Examiner Tip

Take care to read the question carefully and include specific details in your answer.

Question 3 (a)

This question concerns two species of grass snake found in lowland regions in the south of England. Candidates were asked to state what is meant by the term species; a term which is given in the specification.

Most candidates were able to give a definition of a species. A few candidates lost the mark because they did not give both parts of the definition; the ability to interbreed and the fact that the offspring are fertile.

3 A study of the genetics of grass snakes has led to the identification of a new species of grass snake in the UK.

The barred grass snake was thought to be a variation of the common grass snake, *Natrix natrix*.

However, the barred grass snake, *Natrix helvetica*, has been found to be a different species.

Both types of grass snake are normally found in lowland regions in the south of England. The snakes can be more than a metre long, are found near water and eat mainly amphibians such as frogs and newts.

The common grass snake is olive green with a bright yellow collar.

The barred grass snake, shown in the photograph, is grey with black markings.



(a) State what is meant by the term species.

(1)

A group of organisms which are able to interbreed to produce fertile offspring.

ResultsPlus
Examiner Comments

A clear answer that gains 1/1.

A group of organisms with ~~the same~~ similar characteristics that can interbreed. Genetically similar.

ResultsPlus
Examiner Comments

This response did not gain a mark because it failed to state that the offspring are fertile.

ResultsPlus
Examiner Tip

Make sure you learn the definitions of terms in the specification.

Question 3 (b)

This question asked how DNA profiling could be used to show that the snakes were different species. Most candidates gained some marks but many failed to gain full marks by not linking their answer to the snakes in the question. Many responses gave a generalised description of DNA profiling, often including a detailed description of the process of PCR. This is not relevant to this question. Many candidates referred to STRs, which were also not relevant here, while very few referred to fragments. There were, however, some very good answers to this question which demonstrated excellent understanding.

(b) Describe how DNA profiling could be carried out to show that these snakes are different species.

(4)

DNA From a body cell of each snakes is extracted and stained with a flurescant dye. The DNA is then fragmented using a restriction enzyme. The Fragmented DNA is then added to the pits of an gel electrophoresis tank and a potential differe delivered to a buffer solution to separate the DNA fragments. Under UV light, the Fragmented DNA of the two species can be cross examined by the distance the DNA Fragments travelled in the gel. Significant variance suggest they are two different species.

ResultsPlus
Examiner Comments

This response clearly answers the question. DNA is taken from both snakes, restriction enzyme is used to produce fragments of DNA, and there is a description of gel electrophoresis. There is an explanation of how the DNA fragments are separated. 4/4.

The final marking point would not be awarded because it is not clear that the pattern of bands is compared.

A sample from each snake species is taken and treated with detergent & a buffer solution to break open the cells and then release the DNA. Then protease is added to remove excess proteins and restriction enzymes are added to cut DNA at specific base sequences of DNA to produce fragments. Then the fragments DNA primers, DNA polymerase and free nucleotides are added to a PCR tube. It is heated and At 95°C the hydrogen bonds break, at 55°C DNA primers attach and at 70°C the DNA Polymerase binds adding free nucleotides extending the STR sequence. ~~Then Southern blotting is used to~~ ~~[illegible]~~ Then the fragments undergo electrophoresis to seperate them depending on their size. This is done by putting the fragments in wells in agarose gel, adding a buffer solution & applying an electrical current. Southern blotting is then used to visualise the fragments by transferring them to a nylon base. Then under UV light the fragments can be visualised and ~~for them to be the same species~~ compared to see how many bands they have in common.

ResultsPlus
Examiner Comments

A clear answer gaining 4/4. The DNA is taken from both snakes, restriction enzymes are used to produce fragments of DNA, and there is a description of gel electrophoresis used to separate the fragments. The description of PCR is not relevant to this question and can be ignored. The final marking point would not be awarded as it does not state the impact of similar bands.

ResultsPlus
Examiner Tip

Make sure you read the question carefully and select the correct information for your response.

Question 3 (c)

This question asks candidates to explain how these two species of snake could have arisen from a common ancestor. Both species of snake occur in lowland Britain. Most candidates were able to describe the process of evolution by natural selection, however, many lost marks because they didn't apply this knowledge to the situation they were given. The two most common marks were for reproductive isolation and a change in allele frequency. Very few candidates referred to variation in the population of grass snakes or explained the advantages of changes in colour. There were many incorrect references to allopatric speciation, with descriptions of geographical isolation which did not relate to the habitat of these two species.

(c) Explain how these two species of snake could have arisen from a common ancestor.

(4)

- Due to varinhon in genes mutation could occur in some ~~same~~ snakes
- selection pressures of environment may have caused a particular colour marking to be more advantageous (as it may help snake camoflage more)
- this allows snake to have a higher chance of surviving and reproducing, which passes advantageous allele onto the next generation
- genetic isolation will prevent two gene pools from mixing and over many generations some snakes will not be able to interbreed to produce fertile offspring

ResultsPlus
Examiner Comments

This response gains 3 marks. It explains that those which were better camouflaged were more likely to survive and, therefore, reproduce, leading to two gene pools and, eventually, snakes which were unable to interbreed.

It does not gain the first mark point because, although there is a reference to mutation, it is not clear that this leads to variation within the population of grass snakes.

ResultsPlus
Examiner Tip

Always read the information in the question carefully and construct your answer within the context you are given. Generic answers about natural selection could only gain 2 marks.

This snakes live in the same region therefore sympatric speciation could have occured. This could have been because a random mutation has ccused a common ~~the batted~~ grass snake to have a grey colour with black markings. This didn't attract some females to mate with it and only some did. This snake reproduced and passed on the allele for the different colour. After many generations the frequency of this allele has increased and only ~~the~~ grey snakes would mate with grey snakes. There was no gene flow between the two populations after years the populations became two different species as they couldn't inbreed to reproduce to give rise to a fertile offsprings. This form of sypatric speciation arises through changes in mating. **(Total for Question 3 = 9 marks)**

ResultsPlus
Examiner Comments

This is a well constructed answer that gains full marks. There is a correct reference to sympatric speciation, and an explanation of how mutation has led to different coloured markings on some snakes. The change in allele frequency is described, leading to two species and reproductive isolation.

Question 4 (a) (ii)

This question concerns the effect of cooking on vitamin C.

Candidates were to calculate, using the data provided, the mass of cooked cauliflower that would provide 90mg of vitamin C.

Most candidates carried out this calculation successfully. A number of candidates did not gain full marks because they did not give the correct units.

(ii) The recommended daily value (DV) of vitamin C for men is 90 mg.

Calculate the mass of cooked cauliflower that would provide 90 mg of vitamin C.

(2)

100g = 20mg vit. C.

4.5 x 20 = 90

100 x 4.5 = 450

Answer 450

ResultsPlus
Examiner Comments

This response gains 1 mark. The answer is correct but no units are given.

cooked cauliflower has vitamin C conc. of 20mg per 100g (2)

$\frac{90}{20} = 4.5$

$100 \times 4.5 = 450g$

Answer 450 g

ResultsPlus
Examiner Comments

This gains full marks for a correct answer with units.

Question 4 (b)

This question asked candidates to devise a procedure to investigate the effect of cooking on the vitamin C content in cauliflower. This is based on a year 1 core practical where students determined the vitamin C content in fruit juice.

Candidates are expected to be able to recall the practical and apply it in an unfamiliar context. There were many good descriptions of the titration, with candidates correctly recalling the colour change. Several candidates lost a mark because they referred to cooking the cauliflower at a range of temperatures or time and ommitted uncooked cauliflower.

It is expected at this level that candidates will use terms such as *mass* and *volume*, not *amount* or *drops*.

(b) Devise a procedure that can be used to investigate the effect of cooking on the vitamin C content of cauliflower.

(4)

~~Get~~ Cauliflower of the same species and age should be used. Temperature should be ~~In order to get the~~ controlled. ~~juices of the cau~~ Cook the different cauliflower ~~at~~ for ~~diff~~ a known number of different times. Then Place a known volume ~~of~~ and concentration of DCPIP in a conical flask and titrate each of cauliflower's ~~at~~ water cooked at different times in the burette. Add the cauliflower water into the DCPIP drop by drop until the DCPIP goes from blue to colourless. Compare this to a standarised vitamin C solution. Repeat the experiment at each cooking time & calculate the mean.

(Total for Question 4 = 7 marks)

ResultsPlus
Examiner Comments

This response gains 2 marks. Controlling the volume and concentration of DCPIP is described, and a comparison is made to a standardised vitamin C solution. There is no reference to the mass of cauliflower used and, although a number of cooking times are used, none of it is uncooked. The titration with DCPIP is described but the mark cannot be awarded because *drops* is used instead of *volume*.

(4)

Cauliflower florets of ~~the~~ about the same ~~size,~~ ~~surface~~ size and mass, cut from the same plant, could be cooked in boiling water for various intervals (eg. from 0 to 10 minutes, at intervals of 2 minutes). The cooked florets should then be blended on pulse with 60ml distilled water to release their vitamin C ~~into the~~ into the solution. Each of the cauliflower extracts should then be titrated with DCPIP solution, and the volume taken ~~to~~ to decolourise it recorded. By using the ratio at which vitamin C reduces DCPIP, the concentration of vitamin C in each sample extract can be ~~recorded~~ calculated, and this used to find the vitamin C present in each floret after each amount of cooking for comparison.

(Total for Question 4 = 7 marks)

ResultsPlus
Examiner Comments

This response correctly describes using both cooked and uncooked cauliflower of the same mass. The titration with DCPIP is correctly described. It gains 2 marks.

ResultsPlus
Examiner Tip

Ensure that all of year 1 work is revised thoroughly, including the core practicals.

Question 5 (a)

This question concerns changes that occur in a body after death and the effect of environmental factors on these changes.

Candidates are asked to explain the effect of ambient temperature on the rate of decomposition.

Many candidates answered this well, mostly gaining the first two marking points. Few candidates went on to link this to decomposers and only the best answers actually mentioned the growth rate of the decomposers. As the command word is ''explain'', this link is required to obtain full marks. Most candidates were able to link the decomposition to enzyme activity but many gave detailed accounts of enzyme action which wasted time and did not earn any extra marks. Candidates should be encouraged to give specific details that are relevant to the question.

Not all students are aware of the meaning of ambient temperature, some seemed to think it was a specific temperature.

5 The extent of decomposition is important in helping to determine the time of death of a mammal.

Body farms are outdoor laboratories where experiments take place to investigate the changes that take place after death in a range of conditions. Body farms use the bodies of pigs or donated human bodies.

The effects of factors such as temperature, moisture and position of the body on the rate of decomposition can be studied.

(a) Explain the effect of ambient temperature on the rate of decomposition.

(3)

A higher ambient temperature caused an increase in the rate of decomposition as it decreases the rate of heat loss from the body so core temperature remains higher. This increases the rate of enzyme controlled reactions during decomposition ~~and~~ as enzymes and substrates have higher kinetic energy so more enzyme - substrate complexes form.

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Examiner Comments

This response gains 2 marks for stating that a higher ambient temperature causes an increase in the rate of decomposition and linking the increase in temperature to enzyme activity.

If the ambient temperature ~~is high~~ increases, then ~~decomposers~~ the rate of decomposition also increases. This is because particles move faster with more energy, so there's more successful collisions so the rate of enzyme activity increases, decomposing the body ~~temperature~~ quicker. Also, higher temperatures speed up the growth and life cycle of decomposers, increasing the rate of decomposition. Lower temperatures cause the rate of decomposition to decrease, because particles move slower with less energy, so there's less successful collisions and the activity of enzymes decreases.

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Examiner Comments

This response states that the increase in temperature increases the rate of decomposition and explains the effect on enzyme activity. It goes on to explain that this will cause the decomposers to grow faster, an alternative to increased growth rate. It gains 3 marks.

Question 5 (b)

This question asked for a description of the changes which occur in a body within the first week after death. The majority of candidates appear to have good knowledge of this topic, with many scoring full marks. Some candidates described insect succession, which is not relevant as they were asked for changes that occur inside the body.

(b) Describe the changes that occur inside a body in the first week after death.

(3)

Initially the body temperature drops and after 8 - 12 hours Rigor Mortis sets in which is the stiffening muscle contracts. Muscles relax after 24 hours as the body starts to internally decompose. Insects such as maggots take host in the body easier if a wound is present. The rate at which it will decompose depends upon temperature of surroundings, moisture and position of the body.

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Examiner Comments

This response gains 2 marks, for correctly describing the fall in body temperature and the onset of rigor mortis. The comment about maggots does not answer the question and is not awarded any marks.

All the muscles will stiffen and then relax due to rigor mortis. The core body temperature will drop in a sigmoid curve. Also early signs of decomposition will occour, such as putrigication, and gas and liquid blisters forming, as the body proceeds to break down.

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Examiner Comments

This candidate has correctly described rigor mortis, the fall in body temperature, and putrefaction. It scores 3 marks.

Question 5 (c) (i)

This question asked how pigs could be used to study the changes in insect species on a body after death. Many candidates gained marks for stating that the presence of different species of insects should be recorded at regular intervals, however, candidates could not score marks because they did not answer the question. Responses either described a study of the effects of changing environmental conditions or gave a description of the stages of succession that are known to take place on a human body after death. Few responses referred to controlling environmental conditions or standardising the pigs. A significant number of candidates started to give the answer to the next question. Candidates should be encouraged to read through all parts of a question before starting to answer.

(c) Body farms use the bodies of pigs to study the changes in insect species on a body after death.

(i) Describe how this study could be carried out.

(3)

measure the time of death and after each day take a sample of insects seen on the body and identify them. repeat this every day. Repeat this with multiple pigs to ensure there are no anomalous results.

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Examiner Comments

This response gained 2 marks for sampling the insects every day and identifying them. Identifying the insects is a prerequisite to recording them.

Pigs of the same species that have the same ~~test~~ of time after death when the investigation is carried out, would be examined at ~~regular~~ regular intervals to observe the types of species of insects present on the pig. The pigs should be kept in the same area with the same ~~tem~~ surrounding temperature to ensure these other factors don't effect the species present. The data would be recorded & compared to see if the same species is present on the different pigs & conclusions could then be made.

ResultsPlus
Examiner Comments

This is a clear response which gains 3 marks. It states that the pigs will be examined at regular intervals, the species of insects will be observed and recorded, and the temperature will be controlled.

Question 5 (c) (ii)

Candidates are asked how they could use the results of the study on pigs to establish the time of death of a human. It required a comparison to be made between the insects present on the human body and the results of the study of pigs. This was not a high scoring question because many of the responses were generic and made no reference to the study on the pigs, merely giving an account of the succession of insect species or methods used to establish time of death.

(ii) Explain how the results of this study could be used to help to establish the time of death of a human.

(3)

We can look at the abundance of a certain species of insect as well as the species richness and how many species are present. The pig can be an indicator of the suitable conditions for each species of insect, so we can compare the condition of the body with the different species that present to determine the time of death. As long as surrounding conditions are similar, the type of insects that colonise at a certain time should be similar.

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Examiner Comments

This response scores 3 marks. The first sentence establishes the recording of the insect species on the body. It then goes on to make a comparison with the data from the pig study. The last sentence recognises the need to take environmental variables into account.

observer look at which species are on the body and compare with the results of the investigation to see at which time after death the organism comes to the body.
Also lookout for any eggs that may have been laid on the body. to recognize which species have infested and left the body.

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Examiner Comments

This response gains 2 marks. The species present are recorded and compared with the study on pigs. The reference to the investigation in this context can be taken as the study on the pigs. The reference to the presence of eggs is not enough for the mark which takes the stages of the life cycle into account.

Question 6 (b)

This question asked candidates to calculate the actual length of the mitochondrion in the diagram by measuring the image and using the magnifaction to calculate the length. The majority of candidates knew the equation required but many did not measure the distance accurately. Others were not able to convert their answer into the correct units.

The exact length of the image was 116mm and full marks could only be obtained if this length was used in the calculation with correct units. Candidates achieved 1 mark if they measured the length to 115mm and went on to give a correct answer and units. Many candidates scored 1 mark for giving the answer 5.75um, obtained by measuring the length as 115mm.

(b) The photograph shows an electron micrograph of a mitochondrion from a liver cell.



Magnification ×20 000

Calculate the maximum actual length of this mitochondrion.

(2)

Mag = $\frac{\text{img}}{\text{actual}}$ $\quad 20,000 = \frac{11.5 \text{ cm}}{\text{actual}}$

$20,000 = \frac{11\,500}{\text{actual}}$ (μm)

$= 5.75$ μm

Answer .....

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Examiner Comments

This response gains 1 mark. The length was measured as 11.5cm instead of 11.6cm, but the correct answer from this measurement was given with the correct units.

Calculate the maximum actual length of this mitochondrion.

(2)

11.6cm
= 0.0116μm

$\frac{11.6}{20,000} = 5.8 \times 10^{-4}$
$= 0.00058$ cm

Answer 5.8×10^{-4} cm

~~0.0116 / 20,000 = 5.8×10^{-7}~~

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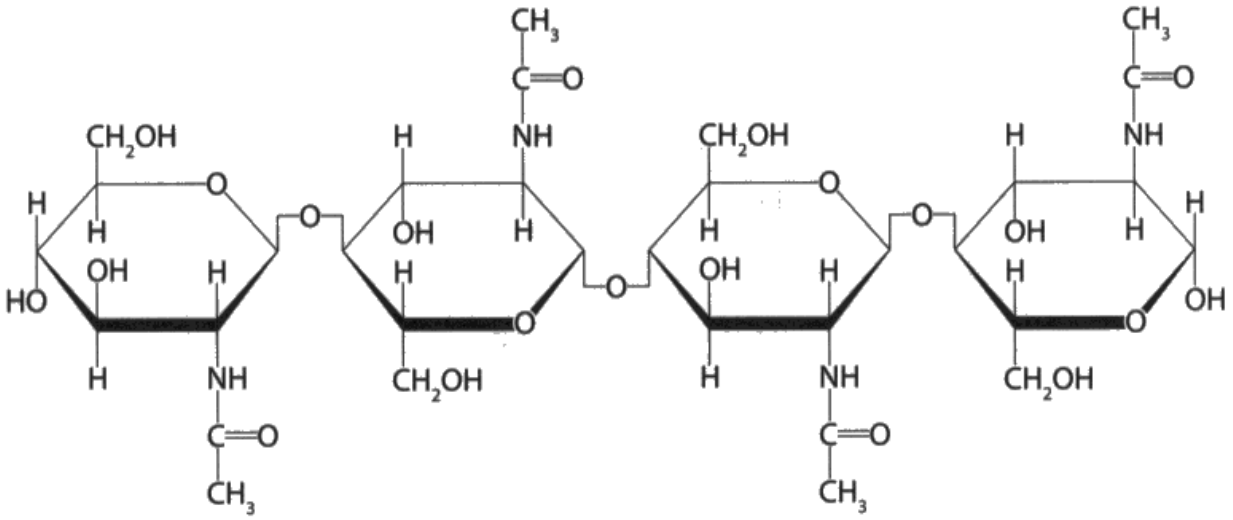
This response gains 2 marks for providing the correct answer and appropriate units. Answering in cm with the use of standard form is an acceptable way of expressing the answer.

Question 6 (c)

This question asked candidates to compare and contrast the structure of two polysaccharides, chitin and cellulose. Chitin is unfamiliar; candidates needed to use information from the diagram given. Cellulose is in the specification and candidates are expected to recall the structure.

When asked to compare and contrast, a comment needs to be made about both components. Candidates lost marks by making a comment on one of the molecules without offering a corresponding comment about the other. Full marks can only be obtained by identifying at least one similarity and one difference. Unfortunately, many candidates referred to molecules being inverted rather than monomers. As chitin is described as a molecule in the stem of the question, it is not clear which molecule they are referring to. There were many vague comments about different types of glucose molecules.

(c) **The diagram shows part of a molecule of chitin, a modified polysaccharide found in fungal cell walls.**



Compare and contrast the structure of chitin with that of a cellulose molecule.

(3)

There are both polymers of glucose joined by condensation reaction. Cellulose is a beta glucose molecule and lacks the NH and CH_3 groups which are found present in chitin. They both have glycosidic bonds. Cellulose also lacks a double bond between Carbon and Oxygen (C=O) which is present in chitin.

ResultsPlus
Examiner Comments

This response scores 2 marks.

One similarity is given: both have glycosidic bonds.

One difference is given: cellulose lacks NH and CH_3, which is present in chitin.

ResultsPlus
Examiner Tip

In a compare and contrast question, remember to make a comment on the similarities and differences for each.

cellulose are comprised of β-molecules that are alternatively ~~turned~~ flipped by 180°, which is similar to chitin: the monosaccharides that make up chitin are also alternately turned 180°. Both molecules are formed by condensation reactions between monosaccharides to form a polysaccharide, and are linked by 1,4-glycosidic bonds. cellulose and chitin differ in the group attached to the second carbon: chitin has a $NHCOCH_3$ group, whereas cellulose has an -OH group.

ResultsPlus
Examiner Comments

This is a clear response that gains 3 marks.

The similarities given are that both have every other monosaccharide inverted and both have glycosidic bonds.

The difference is in the side chains.

Question 7 (a)

This question asked candidates to describe how a peptide bond is formed. Almost all candidates gained at least 1 mark for stating that a condensation reaction takes place. There were some very good answers that gained full marks for going on to describe the reaction between the amino group and carboxyl group of adjacent amino acids.

7 Some species of bacteria have developed resistance to antibiotics.

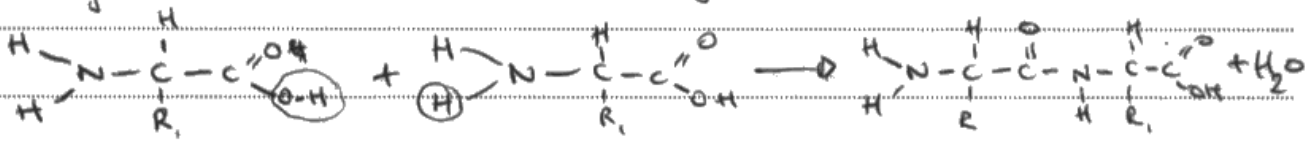
This has led scientists to investigate many molecules for antimicrobial properties.

Peptides extracted from broad bean plants and cowpea plants have been studied.

(a) Describe how a peptide bond is formed.

(2)

• A peptide bond is formed by two amino acids ~~had reacted~~ forming a bond by condensation. As shown in the diagram below, the H from the amine side and the OH from the carboxylic side come together to form water leaving the C and N to form a bond.



ResultsPlus
Examiner Comments

This is a good answer which clearly describes the reaction between the amine group and the carboxyl group and states that it is a condensation reaction. It gains 2 marks.

ResultsPlus
Examiner Tip

Diagrams can be very useful but always make sure that they are clearly labelled. This response would not have achieved the mark for the diagrams alone.

A peptide bonds forms between two amino acids, between the carboxyll group of one and the NH_2 group of another. It is formed by a condensation reaction which is the removal of water

ResultsPlus
Examiner Comments

This response scores 2 marks for stating that a condensation reaction occurs between the caboxyl group of one amino acid and the NH_2 group of the other amino acid.

Question 7 (b)

This was a question based on the core practical; investigating the effects of antibiotics on bacteria. The context given was investigating the antimicrobial properties of peptides extracted from broad bean and cowpea plants. Candidates are expected to be able to transfer their knowledge to unfamiliar situations. For example, the correct incubation temperature was 37°C as these bacteria are found in the human body.

Candidates appear to be very familiar with this practical and there were many high scoring responses.

(b) The effects of these plant extracts were tested on pathogenic bacteria. It was found that each extract had an effect on its own, but the effect was greater when used together.

Devise a procedure that scientists may have used to measure the effects of these extracts on pathogenic bacteria.

(4)

Place a pathogenic bacteria on an agar plate. Use aseptic technique which means place instrument through flame before use to prevent contamination and disinfect bench before the experiment. When bacteria added close lid again to avoid contamination and add plant extracts to small paper discs. Add discs to the agar in petri dish and incubate at 37°C in order to replicate conditions of body as some pathogens may not react to plant extract the same at different temperature. After 24 hours measure the zone of inhibition produced with each plant extract (if) there was any zone of inhibition produced

ResultsPlus
Examiner Comments

This response gained 3/4 marks for correctly describing the production of agar plates with bacteria, using paper discs to add the plant extract to the agar plate and incubating at 37^{o} C for 24 hours. There is no mention of using a combination of plant extracts. Although there is a statement to say the zone of inhibition should be measured, there is no comparison so this mark cannot be awarded.

ResultsPlus
Examiner Tip

When asked to devise a procedure based on a core practical, make sure you put it into the context given.

The plant extracts would be soaked in ~~gelatin~~ paper discs (which would have been prestorilised in ethanol and dried) ~~or~~ and placed onto agar plates cultured with a bacteria or placed into wells in the same kind of plate (ensuring only 1 cm^3 of extract is used per plate). This procedure would be done in sterile conditions with an upwards airflow, all surfaces bleached and all tools & glass sterilised before use. The prepared plates would be incubated at 37°C (as the bacteria are pathogenic and the scientists are professionals) for 72 hours. After this each plate would be observed and using a grid system the area of the zone of inhibition would be calculated, the larger the zone of inhibition the further the extract can diffuse and retain its potency and so the more effective it is.

ResultsPlus
Examiner Comments

This response clearly states the correct procedure. It scores full marks.

Agar plates are prepared with a culture of bacteria, paper discs are used to place the plant extracts onto the agar and the plates are incubated at 37°C for 72 hours. A grid is used to measure the zone of inhibition and there is a comparative statement.

Question 7 (d)

This question asked candidates to describe the control practices introduced by hospitals in response to the increase in hospital acquired infections. Candidates generally scored at least 2 marks, mainly referring to the increase in hand washing and isolation of patients.

Marks were only awarded for practices which have been recently introduced, so there were no marks for sterilising equipment or washing bed linen between each patient. Many candidates described the monitoring of antibiotics, which is not relevant in this context.

(d) **Hospitals have developed practices in response to the increase in hospital acquired infections.**

Describe the infection control practices hospitals have introduced.

(3)

They have introduced screening at the entrances of the hospital which shows the doctors immediately who was ill. Moreover, using ethanol hand sanitizers at the entrance of the hospital to stop any pathogenic bacteria from entering is also now being used. The doctors don't wear watches or ties as they could accidentally touch the bacteria and then transfer it to another patient. Isolation rooms are also being used for people with infections so that these aren't transported around the hospitals. All of the equipment is sterilised with ethanol due to the fact that it easily kills bacteria.

ResultsPlus
Examiner Comments

This response gains 3 marks for clearly describing the use of screening and isolation rooms, hand sanitisers and the fact that doctors do not wear watches or ties.

Visitors and doctors must wash their hands before and after visiting patients, in order to reduce the spread of hospital acquired infection. Those who have a hospital-acquired infection are isolated from other sick patients to ensure that they do not pass the illness onto others, who have a weak immune system and are susceptible to the HAI. Pillows and bedsheets must be changed between each patient as bacteria can survive inside the pillow and infect the next patient.

ResultsPlus
Examiner Comments

This response is awarded 2 marks for clearly describing hand washing and the isolation of patients with an hospital aquired infection. It is not awarded a mark for the changing of bedding between patients as there is no reference to changes in the washing process or use of disinfectant.

Question 8 (a) (i)

This question is in the context of the condition venous thrombophilia, where a blood clot forms in the vein. This can be due to the production of overactive factor V and can be inherited.

Candidates are asked to describe the role of thrombin in blood clotting. Many candidates have a good understanding of the process of blood clotting so this question was generally answered well. Not all stated that thrombin is an enzyme.

8 Thrombophilia is a condition that increases the risk of blood clots forming.

This condition increases the risk of venous thromboembolism (VTE), a condition where a blood clot forms in a vein. Thrombophilia due to the production of overactive factor V can be inherited.

Factor V is involved in the conversion of prothrombin to thrombin.

(a) (i) Describe the role of thrombin in blood clotting.

(3)

Thrombin is an enzyme used in blood clotting to catalyse the conversion of soluble fibrinogen to insoluble fibrin. This produces a mesh to trap platelets and to form a blood clot.

ResultsPlus
Examiner Comments

This is a well constructed answer which gains 3 marks for stating that thrombin is an enzyme which catalyses the conversion of fibrinogen into fibrin, producing a mesh to trap platelets.

~~Fibrinin~~ Thrombin is an enzyme that catalyses the conversion of fibrinogen (a soluble protein) into fibrin a (insoluble fibres). Fibrin then forms a tangled ~~web~~ mesh around the area damaged which traps platelets and red blood cells, forming a blood clot.

ResultsPlus
Examiner Comments

This is a clear answer which only includes relevant information. It states that thrombin is an enzyme which catalyses the conversion of fibrinogen into fibrin. This forms a mesh to trap platelets and red blood cells. It gains 3 marks.

Question 8 (a) (ii)

This question asks candidates to explain why a mutation in the gene coding for factor V may increase the risk of VTE. Most candidates recognised the increased risk of blood clotting and many commented on the change in the sequence of amino acids in the protein. Some candidates could not gain marks because they described the effect of the mutation on the sequence of bases in DNA but did not go on to explain how this would effect the protein. Fewer candidates made the link to an increase in the production of thrombin.

(ii) Explain why a mutation in the gene coding for the protein factor V may increase the risk of VTE.

(3)

A mutation is a change in the base sequence of DNA which will alter the sequence of amino acids in the primary protein structure. This will then alter the tertiary and quaternary structure of the protein, causing it to change shape so that it's no longer suitable to carry out its function as the enzyme active site will have changed shape.

Overactive Factor V could cause the blood clot to form to quickly as a result of a mutation, so large volumes of thrombin are produced, increasing the rate at which fibrinogen is converted to fibrin, so blood clots form more quickly.

ResultsPlus
Examiner Comments

This response scores 3 marks. It describes the change in the sequence of amino acids and the effect this will have on the structure of the protein. It explains the increase in thrombin production and links this to an increase in blood clotting.

If factor V is overactive, then too much ~~thrombin~~ thrombin will be produced in the blood and blood clotting ~~and~~ will be more likely to occur in other parts of the circulatory system such as the vein which causes VTE. So if there is a mutation in the gene for VTE, then the protein may be coded for slightly differently which means factor V has a slightly different tertiary structure which means it more successfully converts prothrombin to thrombin, causing the above effect.

ResultsPlus
Examiner Comments

This response scores 2 marks for correctly linking an increase in thrombin production to an increase in blood clotting. The change in the tertiary structure of the protein is not enough for the first marking point.

Question 8 (b)

This question asked candidates to deduce the relative impact of the genotype and environmental factors on the development of VTE using data they were given. The data was from a study determining the incidence of VTE in two different age groups and the percentage of patients with the factor V mutation in each age group.

Most candidates recognised that the incidence of VTE increased with age and many stated that there was a larger percentage of younger people with the factor V mutation. Very few candidates continued on to distinguish between the relative effects of genotype and environment in the different age groups. There were many generalised statements about genotype and environment and candidates incorrectly gave age as an environmental factor.

(b) A study was carried out to determine the incidence of VTE in people of different ages. Those who developed VTE were then tested for the factor V gene mutation.

The results of this study are shown in the table.

Age range	Percentage incidence of VTE in the study group (%)	Percentage of VTE patients with factor V mutation in the study group (%)
less than 20 years of age	1.3	49.3
over 70 years of age	34.0	20.9

Deduce the relative impact of the genotype and environmental factors on the development of VTE.

(4)

As age increases, there is a greater incidence of VTE but those under less than 20 years of age have a higher percentage of patients with factor V mutation. Therefore factor V may be inherited which explains why lots of young people (less than 20 years of age) have it. But, more older people have VTE suggesting this is to do with environmental factors as over 70's may be less active or have other health effects which could increase development of VTE.

suggesting it is a result of the genotype

ResultsPlus
Examiner Comments

This answer gains full marks. It identifies that as age increases there is a greater incidence of VTE and a higher percentage of people with the factor V mutation in the younger age group. It goes on to conclude that genotype has a greater influence in the younger age group whereas environmental factors have a greater influence in the older age group.

The data shows that only 1.3% of the group had VTE and were less than 20. Despite this, 49.3% of the study group had the factor V mutation and were under 20. This is an increase of 28.4% compared to the percentage of the group that are over 70 with the mutation. Although 34% of the people in the group have VTE and are over 70. This would suggest that the relative impact of environmental factors is greater than the impact of genotype. This is because age is an environmental factor and although many more people under 20 had the mutation compared to over 70 years old a lot less actually had VTE. This shows the genotype doesn't impact it as much as the environmental factor of age.

ResultsPlus
Examiner Comments

This response gains 2 marks. The candidate correctly recognises that the incidence of VTE increasess with age and the percentage of patients with the VTE mutation is higher in the younger age group. No further marks can be awarded because the comments about the relative impact of genotype and environmental factors are very general and do not distinguish between the two age groups.

ResultsPlus
Examiner Tip

Take care to read the command word in the question and understand what is required. A ''deduce'' question needs a conclusion to be drawn from information you are given.

Question 9 (a) (i)

An experiment to determine the effect of temperature on the activity of the enzyme catalase in yeast cells provides the context for this question. Candidates are given data of the reaction rates at a range of temperatures and asked to calculate the temperature coefficient (Q_{10}) between two temperatures. The calculation is straightforward but requires candidates to recall how to calculate Q_{10}

Many candidates were able to carry out this calculation.

9 An experiment was carried out to determine the effect of temperature on the activity of the enzyme catalase in yeast cells.

The substrate was hydrogen peroxide. A suspension of yeast cells was added to hydrogen peroxide.

The volume of oxygen produced during the initial two minutes was recorded. This was repeated at a range of temperatures.

The results are shown in the table.

Temperature / °C	Mean volume of oxygen / mm^3
20	80
30	240
40	540
50	320
60	120

(a) (i) Calculate the temperature coefficient (Q_{10}) for this reaction between 20 °C and 30 °C.

(1)

$\frac{240}{80} =$

Answer 3

ResultsPlus
Examiner Comments

A correct answer of 3 gains full marks.

(a) (i) Calculate the temperature coefficient (Q_{10}) for this reaction between 20 °C and 30 °C.

(1)

$\frac{240}{80} = (Q_{10})$

$= 3$

Answer 3

Temperature Coefficient 3

ResultsPlus
Examiner Comments

This response clearly shows the working. A correct answer of 3 gains full marks.

Question 9 (a) (ii)

Candidates were asked to explain the effects of a temperature increase from 20°C to 30°C on the initial rate of activity of catalase. As the rate is increasing, answers need to be comparative and contain **more** kinetic energy and **more** enzyme-substrate complexes.

The question concerns the rate of activity, therefore the second marking point has to state more **frequent** collisions. Many candidates could not gain marks because they referred to more collisions.

(ii) Explain the effects of a temperature increase from 20 °C to 30 °C on the initial rate of activity of catalase in the yeast cells.

(3)

The increase of temperature from 20°C to 30°C leads to a 3 fold increase in initial rate (a 300% increase) of oxygen produced. This is because temperature provides the substrate molecules, in this case hydrogen peroxide, and the enzyme, catalase, more kinetic energy, leading to a higher frequency of collisions and more ~~substrate~~ enzyme-substrate complexes being formed, resulting in a faster rate of product being produced.

ResultsPlus
Examiner Comments

This well structured answer gains full marks. All possible marking points are given, with reference to a threefold increase in the initial rate which refers back to the previous calculation, more kinetic energy, higher frequency of collisions, and more enzyme-substrate complexes.

The rise in temperature increases the kinetic energy of catalase in the yeast cells. This means that they are moving faster and so there are more collisions between the enzyme catalase and the substrate hydrogen peroxide. Therefore, more enzyme-substrate complexes can be formed so the initial rate of reaction is increased. Not all active sites are occupied at first too.

ResultsPlus
Examiner Comments

This response gains 2 marks. The candidate states that there is an increase in kinetic energy, leading to the formation of more enzyme-substrate complexes. The second marking point can't be awarded because it states more collisions, not more frequent collisions.

ResultsPlus
Examiner Tip

When a question is referring to a rate, there has to be an element of time in the answer, for example more frequent, faster.

Question 9 (a) (iii)

This question asks candidates to explain what happens to the Q_{10} value between 40° C and 50°C. It can be seen from the table that the volume of oxygen at 50° C is less than that at 40° C. The rate is therefore decreasing, so candidates are expected to recognise that the Q_{10} is less than 1.0. Many candidates were only awarded 1 mark on this question for recognising that the enzyme is denatured. Of those who achieved the first marking point, most gave a correct value of 0.59 for the Q_{10} rather than stating it is less than 1.0. Many candidates recognised that Q_{10} would decrease but thought it would become negative. If the rate of reaction is decreasing, then it will be below 1.

(iii) Explain what happens to the Q_{10} value between 40 °C and 50 °C.

(2)

$\frac{320/120}{540/120} = \frac{8/3}{9/2} \approx 0.59$ The value decreases because the temperature is too high so the enzymes denature so there are less enzyme-substrate complexes, ~~which~~ reduces the number of enzymes able to form complexes

ResultsPlus
Examiner Comments

This response gains full marks. All three possible marking points are given by providing a value of 0.59 and explaining that the enzymes are denatured resulting in less enzyme-substrate complexes.

- $Q_{10} = \frac{320}{540} = 0.59$
- The Q_{10} value falls as the temperature has become so high that enzymes start to denature
- This shows a fall in initial rate of reaction as there are fewer functional enzymes to carry out the reaction

ResultsPlus
Examiner Comments

This response scores 2/2 for giving the correct Q_{10} value of 0.59 and stating that the enzymes are denatured.

Question 9 (b)

This question asks candidates to discuss the possible impact of climate change on the effects of leaf rust on the yield of wheat crops. The two separate impacts are an increase in temperature, which increases the growth of leaf rust, and an increase in humidity, which increases spread of leaf rust. Most candidates were able to descibe the effects of climate change and recognise the impact on crop yield but many candidates failed to distinguish between the effects of an increase in temperature on growth and the effects of an increase in humidity on the spread of leaf rust. A question with the command word "discuss" requires candidates to explore all aspects of a situation. In some cases, the mark for the spread of leaf rust could not be awarded because there was no reference to an increase.

(b) Leaf rust is a disease caused by a species of fungus. Leaf rust affects cereal crops such as wheat.

Leaf rust yeast spreads through cereal crops when the humidity is high.

Discuss the possible impact of climate change on the effects of leaf rust on the yield of wheat crops.

(4)

Climate change would mean that temperatures would increase and so at higher temperatures the humidity would also increase as more water vapour was evaporated in the air. This would mean that the leaf rust yeast is able to spread through crops faster meaning that a greater number of cereal crops are affected by the leaf rust due to higher humidity. If so, then the yield of wheat crops decreases as a reduced number of crops would not be affected by the leaf rust.

ResultsPlus
Examiner Comments

This response correctly describes the increase in temperature and humidity due to climate change. It links the increase in humidity to an increase in the spread of leaf rust and the resulting effect on crop yield. There is no reference to the effect of an increase in temperature on growth. It gains 3 marks.

As the climate temperature increases as a result of global warming from green house gas emission, ne leaf rust yeast will thrive and grow more on crops because they spread through ~~of~~ crops when humidity is high. This in turn will reduce he crop yeild of plants as he rust is a disease hat affects them. A higher temperature is he optimum temperature for his bactena to grow as it supplies them will mre energy to ~~distri~~ multiply ~~asex~~ asexually This could also mean that mre Carbon is released into he atmosphere as he fungus may use it to respire. This in turn will increase he climate temperature further and create a positive feedback as the yeast thrives more.

(Total for Question 9 = 10 marks)

ResultsPlus
Examiner Comments

This response scores full marks. Climate change is linked to an increase in temperature, increasing growth of leaf rust, and an increase in humidity, leading to an increase in the spread of leaf rust. An observation is made about the reduction in crop yield.

Question 10 (a)

This question asked candidates to explain why anthropogenic emissions of greenhouse gases are affecting the climate, following a quote from the IPCC. Although candidates are familiar with the effect of greenhouse gases, only the better candidates scored highly. In order to explain the effect of anthropogenic emissions, and include an element of reasoning, candidates need to recognise that it is the **increase** in emissions that is causing the problem and causing **more** infrared radiation trapped in the atmosphere. Many candidates referred to damage to the ozone layer, which is not relevant here.

10 The Intergovernmental Panel on Climate Change (IPCC) has issued the following statement:

"Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems."

(a) Explain why anthropogenic emissions of greenhouse gases are affecting the climate.

(3)

Anthropogenic emissions are emissions caused by human activity. An example of this is fossil fuel burning which releases CO_2. The CO_2 concentration in our atmosphere increases which means that more of the suns heat gets trapped beneath the atmosphere and warms earth up. This leads to temperature increases, more extreme weather events and changes in rainfall patterns.

ResultsPlus
Examiner Comments

This is a clear answer that gains 3/3 marks. It gives the example of human activity as the burning of fossil fuels, then explains the resulting increase in carbon dioxide, causing more heat to be trapped in the atmosphere. It would not be given the mark for the increase in temperature because it does not mention the mean temperature of the atmosphere or surface of the earth.

ResultsPlus
Examiner Tip

When answering a question about global warming, remember that it is the **increase** in greenhouse gases which causes the problem. The greenhouse effect itself is needed to keep the planet warm enough for life to evolve.

The climate is affected by anthropogenic emissions. These emissions are causing light to be trapped on earth. This leads to the earth heating up which is global warming. The carbon dioxide level is increasing due to human activity. such as ~~deforestation~~ defrostation of forests is increasing Co_2 levels since plants are not taking in the oxygen. fossil fuels are being burnt which release Co_2 in addition to this cars and energy power plants also release CO_2 and this is affecting the environment and causing global warming.

ResultsPlus
Examiner Comments

This response gains 2 marks for giving deforestation and burning of fossil fuels as the examples of human activity and stating that carbon dioxide levels are increasing. It is not correct to say that light is trapped. Although it states that the earth is heating up, there is no reference to the mean temperature increasing so no mark can be awarded.

Question 10 (b)

This is the first of the level based questions. Candidates were given two sets of graphs of carbon dioxide and pH levels in oceans surrounding several islands over a period of time. They were also told that small snails, which are a food source of a variety of fish, have been sampled and a large percentage were found to have damaged shells. The pH of sea water affects shell formation.

The question then asked candidates to analyse the data in order to discuss the likely impact of increased carbon dioxide emissions on fish populations in these oceans. Candidates scored a full range of marks on this question. Candidates who only commented on one study, or failed to use the data and gave generalised comments, achieved level 1. Many candidates gave answers which considered both sets of data from the graphs and made a link between the changes in pH of the oceans and damage to the shells of snails, achieving level 2. Those who went on to explain the effect of this on the food chain gained a high level 2. The best responses included more detail on the impact on fish populations, and the lack of survival of the snails, gaining level 3. Surprisingly few candidates linked these studies to human activities.

For all areas studied, as carbon dioxide concentration increases, the pH of the oceans has decreased which shows a correlation in the data. This means that a lowered pH is affecting the growth of the snail shells, leading them to be cloudy and weak with severe abrasions. This means that as more carbon dioxide dissolves into the water, the snails are more likely to die and their population would fall as they cannot survive without a shell. Therefore the decreased snail population would have an adverse effect on fish populations as they rely on the snails as a food source and this would lead to increased competition for food causing the fish population to decrease. However the data for CO_2 and pH has not been recorded for a long time, especially for the canary islands meaning that the results could just show correlation and not causation and another factor may be affecting the growth of snails. It also shows natural fluctuation in the data.

ResultsPlus
Examiner Comments

This is a level 3 response which was awarded 5 marks. There is a clear link between the increase in carbon dioxide concentration and the decrease in the pH of the oceans. The effect on snail shell formation is explained, and the impact this will have on snail survival. The detailed explanation of the effect on the food chain, with comments about competition and the decrease in the fish population, gains level 3. Full marks were not awarded because there is no link to human activities.

ResultsPlus
Examiner Tip

Always think about the command word in the question. ''Discuss'' requires candidates to identify the issue or situation and explore all aspects of it to give a reasoned response. When asked to analyse the data, make sure the response refers to all the data. Avoid just quoting figures.

The graphs shows that there is a significant increase in average CO_2 concentrations in the water, most likely caused by increased CO_2 emissions. The increasing CO_2 levels are showing to be causing the pH of the water to reduce. This has shown to be a possible cause of damage to the shell formation of the sea snails. This could reduce the life span / capability (loss of protection) for the snail to reproduce. This means an overall decrease in the population of the sea snails. As these snails act as a food source for many fish (salmon, mackerel and herring,) it could mean that the populations of fish that feed on the snails could decrease as they have a decrease in accessibility to food (this could mean fish die from starvation before reproducing, decreasing population).

ResultsPlus
Examiner Comments

This is a level 3 response which scores 5/6. There are clear links between the increase in carbon dioxide concentration and the fall in pH of the oceans. The effect of this on shell formation and the impact on the fish population is explained. The response continues, making links to the increase in carbon dioxide emissions and explains that the snail population will fall due to their inability to reproduce; achieving level 3.

Carbon dioxide (CO_2) emmissions are likely to negatively impact fish population in ~~the~~ oceans. This is because increasing CO_2 in the water is ~~correlated~~ ~~caused~~ causes a decrease in water pH, turning it more acidic. This results in damage to the Snails shells as it interferes with shell formation. This can be supported with pH steadily decreasing in Hawaii and 53% of Snails within the sample having broken shells.

ResultsPlus
Examiner Comments

This is a level 2 response, gaining 3/6 marks. There is consideration of both studies. The link is made between the increase in carbon dioxide concentration, the fall in pH of the oceans and damage to the shells of the snails. There is no comment on the effect on the fish population, therefore, it is a lower level 2.

Question 10 (c)

This question asked candidates to determine the relationship between an increase in temperature and the life span of the fruit fly using the data given. Most candidates gained at least 1 mark for correctly decribing the inverse relationship. Many went on to give a quantitative element to the response, gaining full marks.

(c) Climate change can also affect the life cycle of organisms.

The effect of temperature on the lifespan of fruit flies (*Drosophila melanogaster*) was investigated.

The results are shown in the table.

Temperature / °C	Lifespan / days
15	130.3
21	86.3
27	41.6
30	20.4

Determine the relationship between the increase in temperature and the change in lifespan.

(2)

As the temperature increases, the lifespan of the fruit flies decreases. For example, the increase in temperature from 15°C to 30°C, there was a decrease in lifespan of 109.9 days.

ResultsPlus
Examiner Comments

This response correctly describes an inverse relationship between the two factors and calculates the change to the lifespan in days. It gains full marks.

as temperature increases lifespan decreases showing a negative relationship between temperature and lifespan. inverse relationship.

ResultsPlus
Examiner Comments

This response scored 1 mark for correctly describing the inverse relationship between temperature and lifespan. There is no numerical element so the second mark cannot be awarded.

ResultsPlus
Examiner Tip

Make sure you are familiar with all the command words. When a question asks you to determine something, maximum marks will only be awarded if there is a **quantitative** element to the answer.

Question 11 (a)

Batten disease was used as the frame of reference for this question. Candidates were asked to explain what is meant by an inherited recessive disorder. Many candidates were able to explain that it is only expressed if the genotype is homozygous recessive, although some candidates were confused with the terms, making reference to homologous recessive. Very few candidates stated that it is caused by a faulty allele.

11 Batten disease is a rare, inherited disorder of the nervous system. It usually begins in childhood. It is a recessive disorder.

(a) Explain what is meant by an inherited recessive disorder.

(2)

two alleles of the the recessive disorder must be present. Can not be inherited if dominant allele is present

ResultsPlus
Examiner Comments

This response scores 1 mark for stating that two recessive alleles are needed.

Inherited recessive disorder means that the diseam is coded for by a recessive allele and will only be inherited if the genotype is homozygous recessive

ResultsPlus
Examiner Comments

This response gains 1 mark for stating that the genotype has to be homozygous recessive.

ResultsPlus
Examiner Tip

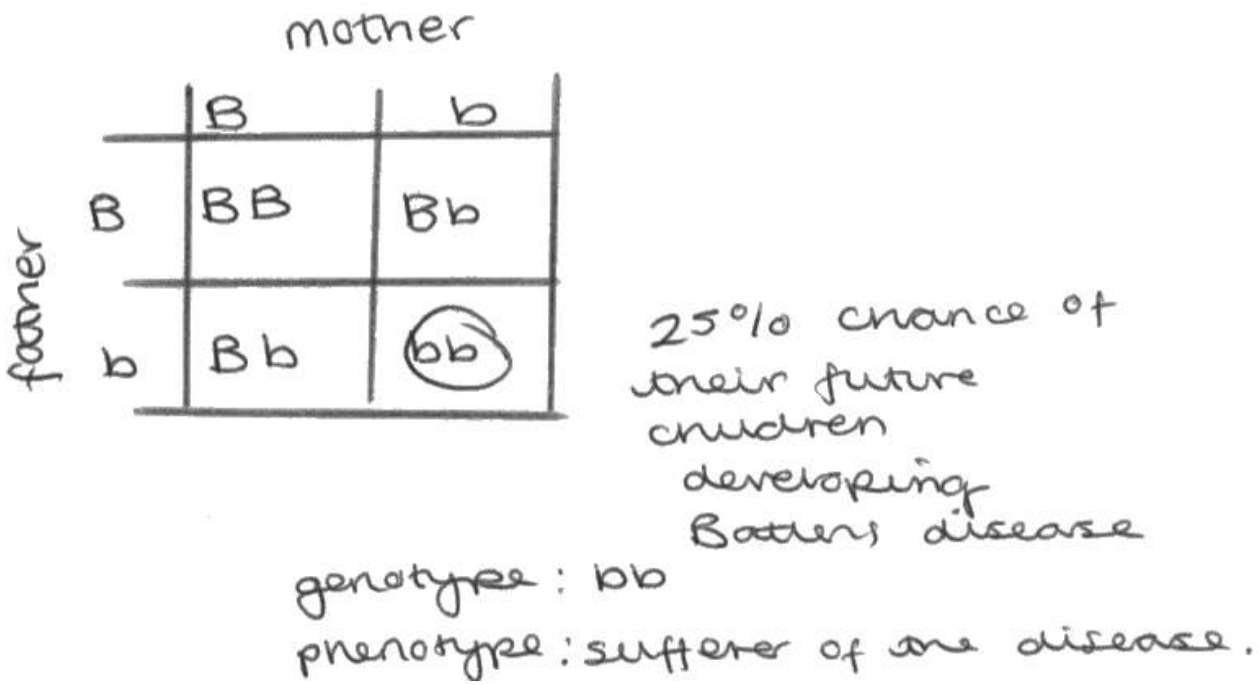
Make sure you learn the meanings of all the terms given in the specification.

Question 11 (b) (ii)

This question, set in the context of Batten disease, asked candidates to draw a genetic diagram to show the probability of future children having Batten disease if both parents are carriers. Candidates demonstrated a good understanding of this topic, with the majority gaining full marks.

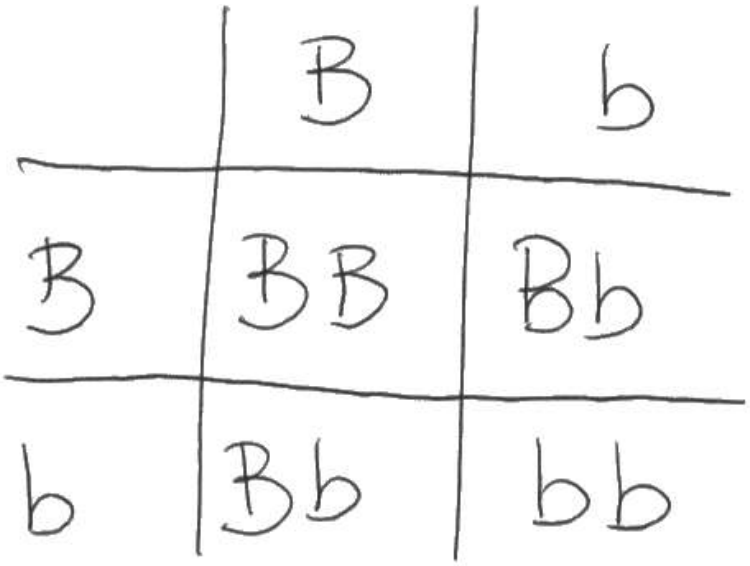
(ii) Draw a genetic diagram to show the probability of their future children developing Batten disease.

(2)



ResultsPlus
Examiner Comments

A correct genetic diagram showing the genotypes of the offspring and a correct probability gains full marks.



25% probability their child will develop the Batten disease.

ResultsPlus
Examiner Comments

Correct genotype of the offspring and correct probability gains full marks.

Question 11 (c)

This is the second of the level based questions. Candidates were given information on some types of genetic screening and where they may be used. They were asked to assess the advantages and disadvantages of these types of screening. Many candidates were able to discuss advantages and disadvantages of several of the types of screening, therefore, achieving level 2. Amniocentesis and CVS were discussed in the most detail. The distinction between blood tests to identify carriers of a genetic disease and blood tests to identify patients at risk of developing a disease were generally not well identified.

Only the better candidates reached level 3, which requires a conclusion or a judgement; for example, the relevant impacts of blood tests and pre-natal screening.

Assess the advantages and disadvantages of these types of screening for genetic disorders.

(6)

~~Advantages~~ :

- An advantage of all is that you can see if the fetus of the person has the disease or will develop it.
- An advantage of amneocentesis and CVS, NIPD and PGD is that it can tell you if the fetus has the disease then the parents can decide if they wish to still have the baby if it have the disorder.
  - ↳ however there are some disadvantages, especially of CVS and aminocentis as they may damage the fetus during extraction to be tested → may result in a miscarriage. Also IVF involved in PGD is very expensive. Also there are many ethical issues surrounding abortion - the sanctity of life.
- A disadvantage of all of them is that the is the risk of a false positive or false negative, this may result in an abortion of a healthy baby. A advantage of the blood testing is that it can help them if a treatment is needed or they can

(Total for Question 11= 11 marks)

TOTAL FOR PAPER = 100 MARKS

tayler their lifestyle if they are at a high risk of developing breast cancer and try to avoid the risk factors.

ResultsPlus
Examiner Comments

This response gives a number of advantages and disadvantages of differet types of screening, referencing in particular to amniocentesis and CVS. No conclusions are made, therefore, it gains level 2, 4/6.

Both blood tests are valid diagnostics tools for adults to do identify a genetic conditions and provide treatment. They're non invasive as only a blood sample is needed and they're cheap as it's a very common used procedure. The wait time for results can vary between week and a month and there might be false positives. There are no ethical issues behind these as they're carried out on consensual individuals.

Amniocentesis and CVS are both procedures to diagnose a foetus. Amn. is (piercing a needle to placeta) slightly more invasive and but only has 1% risk of abortion - it's effective but cheaper than CVS and the wait times are longer. CVS can be done earlier in the pregnancy (8 weeks) but the abortion The results are obtained in days. risk is 1-2%. ~~Both are fairly accurate~~ but it's more expensive. NIPD and PGD are not invasive at all on the foetus. NIPD can be used to identify key disorders though and might present false positives from the mother's blood; it's also very expensive. PGD is the least invasive of all, or even the mothers is unaffected due to it being done to IVF (outside of mother's body). It's super expensive **(Total for Question 11= 11 marks)**

TOTAL FOR PAPER = 100 MARKS

and can be done at the very beginning of the IVF, so it's extremely preventive. Eventually all genetic tests carried out on unborn individuals are extremely useful to parents to prepare in advance and educate them. Although they all raise ethical issues as to the parents terminating the pregnancy and the rights of the unborn foetus (how many weeks before it's illegal to abort etc). PGD also adds to the debate by using IVF, which is extremely selective and can be seen as unethical

ResultsPlus
Examiner Comments

This response gives a detailed analysis of the advantages and disadvantages of various types of genetic screening. A distinction is made between blood tests and tests on the embryo. A judgement is made about the potential benefits of genetic screening. It gains level 3, 5/6.

Paper Summary

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

- make sure that topics 1-4 are revised, as well as topics 5 and 6, for this exam
- make sure that you are familiar with all of the core practicals, including those in topics 1-4
- read all the information provided; it is there because you need it to answer the question
- learn the command words and the type of answers expected
- read the question carefully, identifying the command word and the context - generic answers rarely score high marks
- make sure any measurements you are asked for are accurate and set out calculations carefully
- attempt all the questions - a blank will always score 0
- make sure you add specific details that focus on the question.

Grade Boundaries

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

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