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June 2024

GCE Biology A 9BN0 01

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Introduction

This paper covered a broad range of topics from the specification allowing candidates to demonstrate their knowledge in several different ways. The full range of marks was seen on all questions, meaning there was good scope for differentiation across the paper and for stronger candidates to display their higher-level thinking skills.

Core practicals were covered with some being direct recall and others, application of knowledge and skills to an unfamiliar context. Some candidates muddled practicals together and showed they were not secure in their understanding of the principles of the methodology. Stronger candidates were able to apply their knowledge successfully.

Key terminology was challenged in this paper; indeed, many candidates were able to use this correctly. However, there were a number who were not able to gain some marks due to errors here. This is an area that candidates should build habits on during their study meaning they are less challenged in the pressures of the examination hall.

The levels based questions were generally answered well, particularly by candidates who appeared to have a clear strategy for these items. The key with these is often 'write a little about a lot' and to avoid simply re-stating any stimulus material. Instead, candidates should be prepared to extend the material provided using their own knowledge whilst ensuring they have made use of all the material provided to access the higher levels.

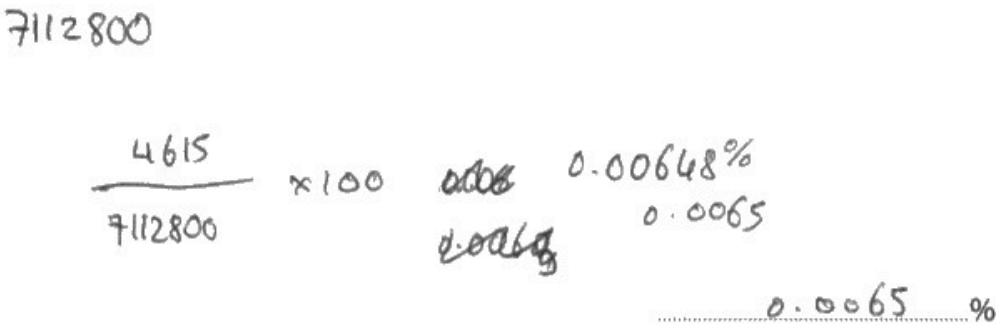
Question 1 (a)(ii)

This question required candidates to carry out a straightforward percentage calculation using data provided. It required candidates to read the question carefully to ensure they selected the correct values. Whilst many candidates did, there were an equal number that did not and so came to an incorrect final answer despite methodology being correct. Credit was given where this had occurred, but candidates dropped potentially straightforward marks through rushing.

Calculate the percentage of the total light energy entering this ecosystem that is fixed as biomass in the primary consumers.

Give your answer to two significant figures.

(2)



ResultsPlus Examiner Comments

This response achieved 1 mark; the correct values for the calculation have been selected, scoring mp1. However, there is an error in writing the final answer and so does not achieve mp2.

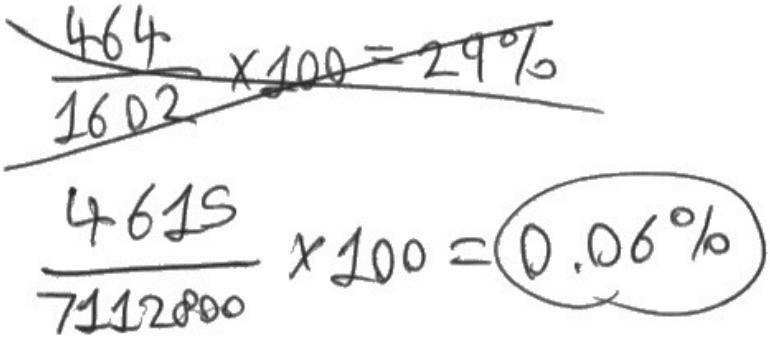
ResultsPlus Examiner Tip

This response demonstrates the importance of showing your working. Without that, this would not have achieved any marks.

Calculate the percentage of the total light energy entering this ecosystem that is fixed as biomass in the primary consumers.

Give your answer to two significant figures.

(2)



29 0.06 %

ResultsPlus Examiner Comments

This response achieved 1 mark. The correct values for the calculation have been selected, achieving mp1. However, the instructions for 2 significant figures have not been followed and so mp2 cannot be awarded.

ResultsPlus Examiner Tip

Read the question carefully and ensure you follow the instructions given!

Question 1 (b)

Most candidates were able to list and give functions of several ions required by plants. Some candidates missed out on mp1 as they referred to nitrogen ions rather than nitrates.

(b) Describe the role of mineral ions in the production of plant biomass.

(3)

~~Calcium ions are involved in the~~

~ Calcium ions are involved in the middle lamella of cells (calcium pectate) allowing cells to remain compact.

~ Magnesium ions are involved in the ~~synthesis~~ production of chlorophyll, therefore is able to convert light energy, water and CO_2 into biomass.

~ Nitrates are needed in proteins, allowing growth of plants to increase their biomass.

ResultsPlus
Examiner Comments

This response achieved maximum 3 marks; mp3, mp2 and mp1; mp4 was not quite there as the process of photosynthesis has not been named.

ResultsPlus
Examiner Tip

Structure your response clearly – this will help both you and the examiner.

(b) Describe the role of mineral ions in the production of plant biomass.

(3)

Mineral ions can be found in the form of nitrogen, which is used in DNA. Magnesium is found in chlorophyll, which is necessary for the production of glucose via photosynthesis - [redacted]

ResultsPlus
Examiner Comments

The response scored 2 marks; mp2 and mp4. Reference to glucose as a named organic molecule was acceptable for mp4. It missed out on mp1 due to reference to nitrogen instead of nitrates.

ResultsPlus
Examiner Tip

Remember nitrogen is not an ion! Ensure you use correct terminology.

Question 2 (a)

This question was well answered with many candidates achieving all four mark points showing candidates have understood and prepared well for questions on this part of the specification. There was varying level of detail seen with some attempts at identifying the number of each of the molecules; these were ignored here as they were not part of the story. There were several references to the role of ATP/NADPH and the regeneration of RuBP; this was not needed here. There were a number of responses that demonstrated candidates had not fully grasped the distinction between the light dependent reactions needing the water as substrate and the light independent reactions requiring the carbon dioxide as they gave very generic responses about photosynthesis in general or referred to the electron transport chain.

2 Anthropogenic activities are increasing levels of carbon dioxide in the atmosphere.

An increased level of carbon dioxide in the atmosphere leads to an increased rate of photosynthesis in some plants.

(a) Describe how carbon dioxide is used in photosynthesis.

(4)

It is used in the light independent reaction (calvin cycle). Carbon dioxide is converted in ~~to~~ to oxygen during ~~the~~ photosynthesis. Carbon dioxide provides carbon for the calvin cycle so that glucose can be made.

ResultsPlus
Examiner Comments

This response achieved 2 marks; mp1 and mp4. Having stated that the carbon dioxide is involved in the light independent reactions, the response then loses focus on this part of photosynthesis and gives general information about the process.

2 Anthropogenic activities are increasing levels of carbon dioxide in the atmosphere.

An increased level of carbon dioxide in the atmosphere leads to an increased rate of photosynthesis in some plants.

(a) Describe how carbon dioxide is used in photosynthesis.

(4)

Carbon dioxide is fixed during the light independent reaction. RuBP reacts with carbon dioxide via RuBISCO to create a 6 carbon intermediate compound which breaks down to form 2x GP, then 2x GALP. $\frac{1}{6}$ is used to combine to a hexose sugar and the remaining many stays in the cycle and more carbon dioxide is fixed to combine it.

ResultsPlus
Examiner Comments

This response achieved 3 marks; mp1, mp2, mp4. Whilst RUBISCO is referenced, it has not been identified as catalysing the reaction so does not achieve mp3.

ResultsPlus
Examiner Tip

If you name an enzyme, remember to identify it as such.

Question 2 (c)

This question was aimed at testing candidates understanding of enzyme concentration as a limiting factor in photosynthesis given the substrate is in excess, requiring them to use knowledge from different areas of the specification. Many candidates followed a different path referring to increase in carbon dioxide leading to global warming or changing the pH and this denaturing enzymes. Those responses that followed the limiting factor story were mixed in the detail they were able to provide with several simply identifying an alternative limiting factor. Several candidates missed this mark as they referred to light availability; at this level, it is expected that candidates can distinguish between intensity and wavelength. When referring to the enzyme, candidates need to be clear what they are referring to; in this case it was enzyme **concentration** that was required. Candidates were also describing the rate of enzyme-substrate complexes as reducing, leading to a fall in the rate of photosynthesis because carbon dioxide was in excess; the reality is at any one time, no more enzyme-substrate complexes can be formed because all the active sites are occupied.

(c) Enzymes catalyse some of the reactions involved in photosynthesis.

Explain why an increase in carbon dioxide concentration above 1000 ppm may not increase the rate of photosynthesis.

(3)

- The enzymes involved in photosynthesis work ~~reacts~~, when concentration of carbon dioxide increases, will increase the rate of photosynthesis until the enzyme reaches it's optimum performance and is unable to increase the rate of photosynthesis further ~~until~~ even when the concentration of carbon dioxide increases further.

ResultsPlus
Examiner Comments

This response did not achieve any marks. It is largely descriptive whereas the command word was 'explain'. Whilst they have stated the '...unable to increase the rate of photosynthesis further...', this is a paraphrase of the question; there needs to be a clear recognition of the limiting/levelling off of the rate of photosynthesis.

ResultsPlus
Examiner Tip

Remember to pay careful attention to the command word! Explain means we want you to tell us **why** something happens.

(c) Enzymes catalyse some of the reactions involved in photosynthesis.

Explain why an increase in carbon dioxide concentration above 1000 ppm may not increase the rate of photosynthesis.

(3)

This is because the active sites of the enzymes e.g. rubisco would be full / saturated thus there would be less frequent collisions between enzymes and substrates and less enzyme-substrate complexes can form between the CO_2 and the enzyme's active sites, because all the active sites are full. Thus increasing substrate concentration (CO_2) would have no effect on rate of photosynthesis and rate of reaction may begin to plateau. CO_2 availability can act as a limiting factor.

ResultsPlus
Examiner Comments

This response achieved 2 marks; mp1 (twice) and mp4. There was an attempt at mp2 but the story given is not quite correct; when substrate concentration is in excess, it will not cause fewer enzyme-substrate complexes to form but no more can form (at any one time) ie. they are being formed at their maximum rate. The reference to carbon dioxide availability as a limiting factor at the end is also not correct.

ResultsPlus
Examiner Tip

Plan your response carefully to avoid repetition; this will save you time in the long run.

Question 3 (a)

This question was not well answered, with all manner of drugs being named. Candidates also named foxglove, which is the source, not the drug.

3 New drugs are tested in clinical trials before they can be used in treatments on patients.

One of the first people to isolate and test a drug was William Withering.

(a) Give the name of the drug he tested.

(1)

Dropsy

ResultsPlus
Examiner Comments

This response did not achieve the mark.

ResultsPlus
Examiner Tip

Remember to distinguish between the disease/illness and the treatment.

Question 3 (b)

Candidates must follow the instructions in the question; they were asked to use ticks and crosses and this had to be followed to be able to access maximum marks here.

Question 3 (c)

Candidates were given information about a drug involved in the treatment of cancer and asked to deduce why the drug works. It was expected they would use their knowledge of mitosis and that cancer cells divide in this way. It was pleasing to see that the full mark range was awarded as many candidates were able to give some details of the process. However, imprecise use of key terminology such as chromosomes and chromatids meant some candidates missed marks. There were also some responses referring to homologous chromosomes which are not a part of mitosis and so did not achieve many marks. Many candidates also paraphrased the question referring to 'not changing in length' when recognition of spindle fibres not being able to shorten was required for maximum marks to be achieved.

(c) Paclitaxel is a drug used in the treatment of cancer.

Cancer involves cells dividing repeatedly in an uncontrolled manner.

Paclitaxel prevents spindle fibres from changing in length.

Deduce why Paclitaxel prevents cell division in cancer cells.

(3)

Paclitaxel prevents cell division in cancer cells by preventing the spindle fibres from changing its length. As the cancer cells divide by mitosis, the chromosomes would not be able to split from its centromere during anaphase as the spindle fibres would be unable to contract and shorten. This means that telophase can not occur and 2 new nuclei can not form.

ResultsPlus
Examiner Comments

This response achieves mp3. There was missing detail referring to opposite poles meaning mp2 was missed.

ResultsPlus
Examiner Tip

Remember to use key terminology correctly and include detail for the steps of mitosis.

(c) Paclitaxel is a drug used in the treatment of cancer.

Cancer involves cells dividing repeatedly in an uncontrolled manner.

Paclitaxel prevents spindle fibres from changing in length.

Deduce why Paclitaxel prevents cell division in cancer cells.

(3)

Mitosis is the process of cell division. Spindle fibres shorten (change length) during the anaphase of mitosis, in which chromatids are pulled by spindle fibres to opposite poles of the cell. However, if (due to spindles remaining the same length) the chromatids are not pulled to opposite poles and the whole chromosomes remain at the equator of the cell, the mitosis cycle can't be completed. As a result cell division doesn't occur preventing cell division in cancer cells.

ResultsPlus
Examiner Comments

This response was awarded all three mark points.

Question 4 (a)

This question was well answered as many candidates were able to give the full story, achieving all three available marks. Candidates should remember the central dogma of this as DNA – RNA – Protein; many candidates missed mp2 as they didn't refer to the RNA. A significant number continued beyond what the question was asking, referring to bonding between different R groups. This achieved no credit and cost valuable time. There were some muddled responses, demonstrating that candidates have not fully grasped the use of correct terminology in the correct places, confusing DNA and protein, bases and amino acids. Candidates were also required to refer to the sequence which cost some marks.

4 Cystic fibrosis is an inherited condition.

It is caused by mutations in the gene coding for the cystic fibrosis transmembrane conductance regulator (CFTR) protein.

Some of the mutations cause a change in the primary structure of the CFTR protein.

(a) Describe how a mutation can change the primary structure of a protein.

(3)

Mutation is likely to change triplet code of DNA. This leads to different mRNA being produced in transcription and this new there's different codons for different tRNA molecules to bind to. So, different amino acids will be brought to ribosome, leading to different sequence of amino acids being made.

ResultsPlus
Examiner Comments

This response achieved all three mark points. They have clearly referred to any changes in the relevant molecules in the correct way.

ResultsPlus
Examiner Tip

Remember the central dogma of DNA – RNA – Protein and stick to what the question is asking. If it is asking how the primary structure of proteins can be changed, there is no need to refer to the tertiary structure and bonds between R-groups.

4 Cystic fibrosis is an inherited condition.

It is caused by mutations in the gene coding for the cystic fibrosis transmembrane conductance regulator (CFTR) protein.

Some of the mutations cause a change in the primary structure of the CFTR protein.

(a) Describe how a mutation can change the primary structure of a protein.

(3)

a mutation can cause ~~a~~ change in the base sequence of an amino acid, this will also ~~change~~ where hydrogen bonds form between R groups. ~~as~~ ~~when the amino~~ The protein will therefore have a different primary structure

ResultsPlus
Examiner Comments

This is an example where imprecise use of terminology has occurred and the candidate has gone beyond the change in primary structure and therefore not achieved any marks.

ResultsPlus
Examiner Tip

Don't paraphrase the question – remember the primary structure is the sequence of amino acids.

Question 4 (b)(i)

The response to this question was varied; there was a lot of reference to apical and basal membranes which was ignored as it was not relevant to the question. The question was asking where the protein was in the cell membrane, not the cell. Several candidates stated it was on the phospholipid bilayer which was not accepted, or they contradicted themselves saying it was extrinsic, going through the full width of the membrane. Some candidates opted to supplement their response with an annotated diagram which was accepted as part of their response if it helped to clarify their statements. Candidates should pay careful attention to their use of descriptive terminology in questions such as these.

(b) (i) The CFTR protein is produced in cells of the lung and is involved in the transport of chloride ions.

Describe the location of the CFTR protein in the cell membrane of one of these cells.

(2)

the CFTR pictein is a channel protein that is located in the cell surface membrane of the cell and spans the entire width of the phospholipid bilayer making it a transmembrane protein. It is located on the membrane that faces the mucus, the apical membrane.

ResultsPlus
Examiner Comments

This response achieved both mark points.

(b) (i) The CFTR protein is produced in cells of the lung and is involved in the transport of chloride ions.

Describe the location of the CFTR protein in the cell membrane of one of these cells.

(2)

CFTR proteins are channel proteins embedded in the phospholipid bilayer of the cell membrane allowing chloride and sodium ions to move in and out of cells

ResultsPlus
Examiner Comments

This response achieved mp1.

ResultsPlus
Examiner Tip

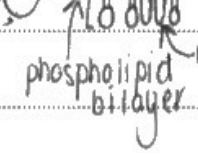
A well annotated diagram would be appropriate here.

(b) (i) The CFTR protein is produced in cells of the lung and is involved in the transport of chloride ions.

Describe the location of the CFTR protein in the cell membrane of one of these cells.

(2)

The CFTR is a channel protein so it is located between adjacent phospholipid bilayers and will run all the way through the bilayer.



ResultsPlus
Examiner Comments

This response achieved both mark points from their writing, but the inclusion of the labelled diagram helped to clarify the descriptive writing.

ResultsPlus
Examiner Tip

If a labelled diagram will help, draw one!

Question 4 (b)(ii)

Many candidates appear to know the story but started with the protein moving from the rough ER to the Golgi apparatus, rather than the ribosome, as asked in the question; this restricted them to a maximum of two marks. Those that did start in the ribosome gave mixed descriptions of the function of the RER, with some candidates saying the protein is modified there rather than folded. Most candidates were able to achieve mp2, with the Golgi modifying the protein. Candidates often referred to the vesicle fusing with the membrane for exocytosis; reference to exocytosis was ignored as the protein would have been inserted into the membrane. We were looking for the idea of the vesicular membrane and the cell membrane fusing together for this mark point.

(ii) Describe how the CFTR protein is transported from the ribosome to the cell membrane. production of proteins?

(3)

CFTR protein made at the ribosomes enter the RER. protein moves through ER assuming 3-dimensional shape in route. The vesicles pinched off from RER contains proteins and vesicles from RER fuse to form flattened sacs of golgi apparatus. In golgi apparatus, protein is modified and vesicles pinched off golgi apparatus contains modified protein. Vesicles fuse with the cell surface membrane and releases the protein, CFTR protein, via the process exocytosis.

ResultsPlus
Examiner Comments

This response achieved all three marks. They have described the journey of the protein from the ribosome to the cell membrane and given correct detail at each step. The reference to exocytosis was ignored.

ResultsPlus
Examiner Tip

Read the question carefully! Start at the point you are asked about, not the next step!

(ii) Describe how the CFTR protein is transported from the ribosome to the cell membrane.

(3)

when the CFTR protein is on the ribosome on the rough endoplasmic reticulum, it is placed into vesicles and then sent to the golgi apparatus. Here it is packaged and sent in vesicles again to the ~~the~~ cell membrane.

ResultsPlus
Examiner Comments

This response achieved mp2 only. Whilst the rough endoplasmic reticulum has been referred to, no function has been associated with it. Similarly, we have the vesicle arriving at the cell membrane but not what happens when it gets there.

ResultsPlus
Examiner Tip

Remember to be consistent throughout your response.

Question 4 (c)

Whilst many candidates were able to achieve all three marks available, a number referred to changes in R-groups affecting the secondary structure or they paraphrased the question stem. The folding marks could only be awarded in the correct context of the tertiary structure.

(c) The most common mutation in the CFTR gene produces a protein that has the incorrect shape.

Explain why a change in the primary structure of a protein changes the three-dimensional (3D) structure of this protein.

(3)

- Primary structure is the sequence of amino acids in the polypeptide chain of a protein.
- A change in amino acid sequence causes a change in R group sequence
- Different R groups will ~~have~~ form different hydrogen bonds with each other for secondary structure
- Different hydrophobic interactions and ionic and disulphide bonding between R groups will change the 3D tertiary structure of the protein.

ResultsPlus
Examiner Comments

This response clearly demonstrates all the mark points in the correct sequence, using the correct terminology.

ResultsPlus
Examiner Tip

Think about your answer before you commit to paper to write in a logical sequence.

(c) The most common mutation in the CFTR gene produces a protein that has the incorrect shape.

Explain why a change in the primary structure of a protein changes the three-dimensional (3D) structure of this protein.

(3)

Change in primary structure results in different Amino Acid R-groups. folding to secondary structure is different - As there is different S-S (disulfur) bridges ionic bonds & hydrogen bonds. As such when further folded the 3D structure is changed / different. (Secondary structure is beta-sheet or alpha helix)

ResultsPlus
Examiner Comments

This response has achieved mp2 only. There is no involvement of R-groups in the secondary structure and so mp3 cannot be awarded.

Question 5 (b)(i)

Most candidates achieved this mark although some missed out as they wrote reduced NAD rather than NADP. Other incorrect answers included carbon dioxide.

(b) (i) Give the names of **two** products of the light-dependent reactions of photosynthesis.

(1)

reduced NADP, ATP

ResultsPlus
Examiner Comments

This response did not score the mark – the P was scribbled out!

ResultsPlus
Examiner Tip

Remember NAD is respiration, NADP is photosynthesis (P for photosynthesis!).

(b) (i) Give the names of **two** products of the light-dependent reactions of photosynthesis.

(1)

ATP and reduced NADP

ResultsPlus
Examiner Comments

The mark was awarded here.

We accepted all variations of expressing reduced NADP.

Question 5 (b)(ii)

This question was well answered, with candidates clearly able to apply their knowledge from the relevant core practicals. Candidates did not have to state the actual temperatures they would use but just give a suitable range for mp1. Candidates were frequently able to refer to adding the same volume of DCPIP, meaning they achieved mp3. Some inaccuracy of description prevented mp5 being awarded to some; candidates would refer to the solution going colourless which is not correct due to the presence of the chloroplasts. It was acceptable to state that the DCPIP went colourless/decolourises. Some incorrect colour changes were given indicating a confusion with some biochemical food tests. Candidates were leaving the tubes for 24hours and then comparing the colours which would not yield appropriate data and so were not credited. Another confusion seen was with the vitamin C titration practical and so some candidates were referring to measuring the volume of DCPIP required to see a colour change. There was extensive writing about the preparation of the chloroplasts which was not needed here; candidates were told they have isolated chloroplasts.

(ii) The rate of light-dependent reactions can be measured in isolated chloroplasts.

Environmental temperature may affect the rate of these reactions.

Describe how DCPIP can be used to measure the effect of temperature on the rate of the light-dependent reactions in isolated chloroplasts.

(4)

1. To isolate the chloroplasts, grind a specific species of plant leaf with an isolation medium, and then centrifuge to produce isolated chloroplasts.
2. In seperate test tubes, add the same volume of the isolated chloroplast solution, and place each test tube in a water bath set to a different temperature. e.g. 5°C, 10°C, 15°C, 20°C, 25°C and 30°C
3. Ensure each test tube is exposed to the same light intensity and humidity.
4. To each, add the same volume and concentration of DCPIP solution, and record the time taken for the DCPIP to decolourise (blue → colourless)
5. DCPIP takes the place of NADP in the light dependent reaction, accepting electrons from the electron transport chain and is reduced. The quicker it is decoloured, the faster the rate of the light depended reaction
6. Carry out repeats to find a mean time to decolourise for each temperature.

(Total for Question 5 = 8 marks)

ResultsPlus
Examiner Comments

This response achieved the maximum four marks; mp1, mp2, mp3 and mp5.

ResultsPlus
Examiner Tip

Use of numbered points helps to structure your response into a logical sequence.

(ii) The rate of light-dependent reactions can be measured in isolated chloroplasts.

Environmental temperature may affect the rate of these reactions.

Describe how DCPIP can be used to measure the effect of temperature on the rate of the light-dependent reactions in isolated chloroplasts.

(4)

Add 2cm³ of isolated chloroplasts to 5 test tubes. The isolated chloroplasts should be from the same species and age of plant. The concentration of the isolated chloroplasts should also be kept the same. The 5 test tubes should then all be placed in 5 different water baths with temperatures of ~~5°C~~ 10°C, 15°C, 20°C, 25°C and 30°C. Let the test tubes be placed in the water baths for 5 minutes. Then add 1cm³ of DCPIP to each test tube and time how long it takes for the DCPIP to decolourise. The temperature at which the DCPIP decolourises in the shortest time has the fastest rate of the light dependent reaction.

ResultsPlus
Examiner Comments

This response achieved the maximum four marks; mp1, mp3, mp4 and mp5.

ResultsPlus
Examiner Tip

When writing practical methods, it can be useful to identify each of the different variables.

Question 6 (a)

A well answered response with all mark points seen with regularity. Piecing together of the response was done as candidates were not asked to compare and contrast anything but to simply describe. Candidates often wasted valuable time giving details on properties and function when this was not asked for. Other confusions were between alpha and beta glucose and some stated that starch is a polypeptide (rather than polysaccharide).

6 Anthropogenic climate change could have caused the warmest years on record in the United Kingdom from 2015 to 2021.

This is leading to changes in the germination of plant seeds.

Some seeds store starch.

(a) Describe the structure of starch.

(3)

Starch is made up of a mixture of amylose and amylopectin, both of which are polysaccharides. Amylose forms long, unbranched α-chains of glucose molecules bonded ~~together~~ with 1,4-glycosidic bonds. Amylopectin is even longer and forms branched chains (1,4-glycosidic bonds between glucose molecules form on chains and 1,6-glycosidic bonds between glucose molecules form between branches). These two combine to form starch, which can then be hydrolysed for energy. It's a good storage molecule as the long polysaccharide chains are insoluble, thus not affecting water concentration in cells.

ResultsPlus
Examiner Comments

This response scored maximum marks of 3. They did waste valuable time giving details of properties and function.

ResultsPlus
Examiner Tip

Focus on what the question is asking – if it is asking about structure, don't give details on properties and function.

6 Anthropogenic climate change could have caused the warmest years on record in the United Kingdom from 2015 to 2021.

This is leading to changes in the germination of plant seeds.

Some seeds store starch.

(a) Describe the structure of starch.

(3)

It contains two polysaccharides. ~~mos~~
Amylose is the unbranched polysaccharide made up of alpha-glucose that are joined by 1-4 glycosidic bonds
~~Also~~ Amylopectin is the branched polysaccharide made up of alpha-glucose joined by 1-4- and 1-6-glycosidic bonds.

ResultsPlus
Examiner Comments

This response demonstrates all our mark points.

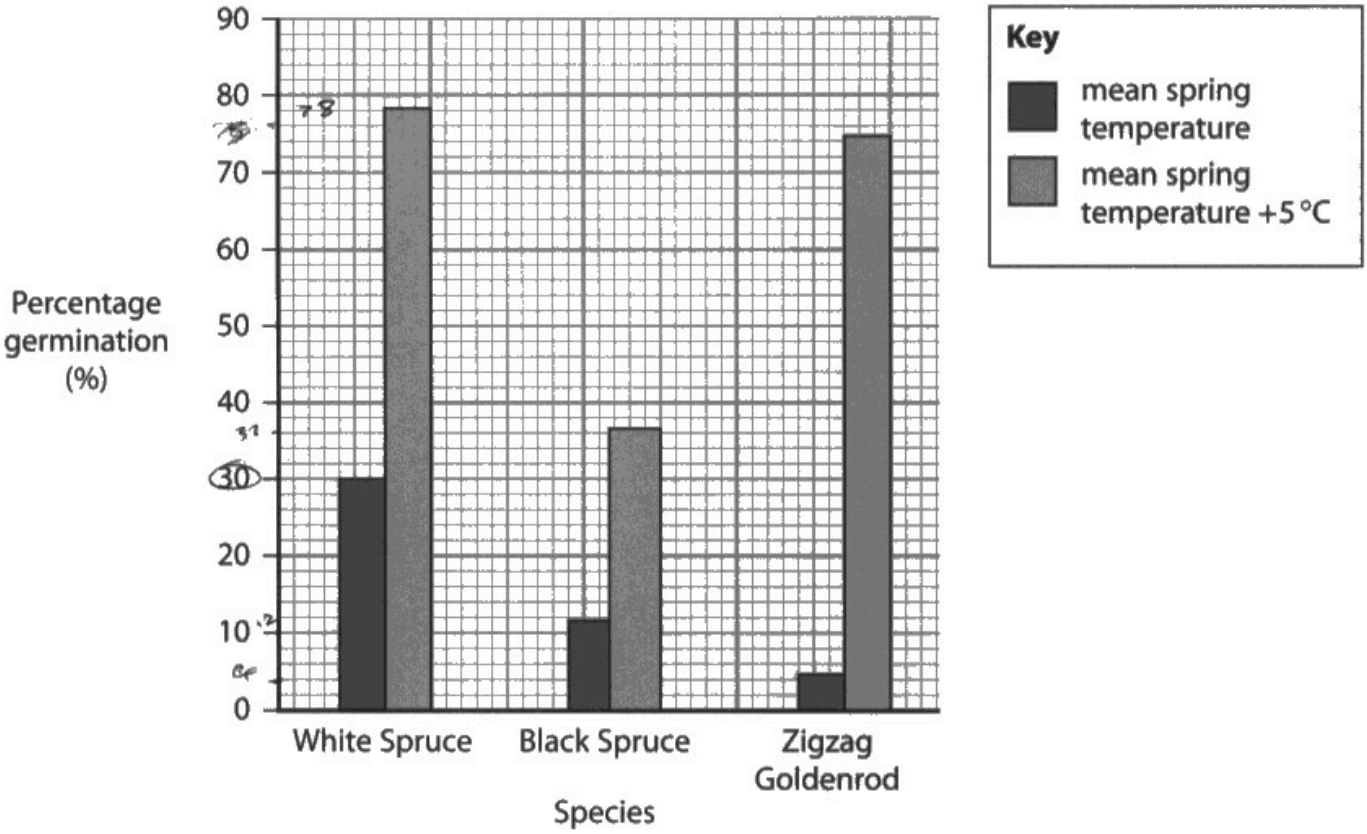
Question 6 (b)(i)

This question caused some challenge for students as they had to be clear they were referring to all three species for mp1. This could have been achieved by describing the data for all three, which some candidates did. However, many candidates did not take this any further, despite the command word 'explain'. The question was asking them to tell us why this happened. Those candidates that did identify the command word correctly often achieved mp2. Candidates frequently referred to more starch being broken down but it was the idea of faster that was needed here. The final mark point was seen but not as frequently as the others.

(b) The starch in seeds is broken down by enzymes during germination.

An investigation into the effect of temperature on germination was carried out using seeds from three species of North American woodland plants.

The percentage germination of these seeds at the mean spring temperature for these woodlands was compared with an increase of 5 °C.



(i) Explain the effect of an increase in temperature on germination of these seeds.

(3)

The increase in temperature leads to ~~creates~~ a higher percentage of germination in all species types. It had the higher increase on Zigzag Goldenrod with a 71% increase in germination. Had an increase on black spruce by 21%. Had an increase on white Spruce 48%.

ResultsPlus
Examiner Comments

This response achieved mp1 – they clearly refer to all three species.

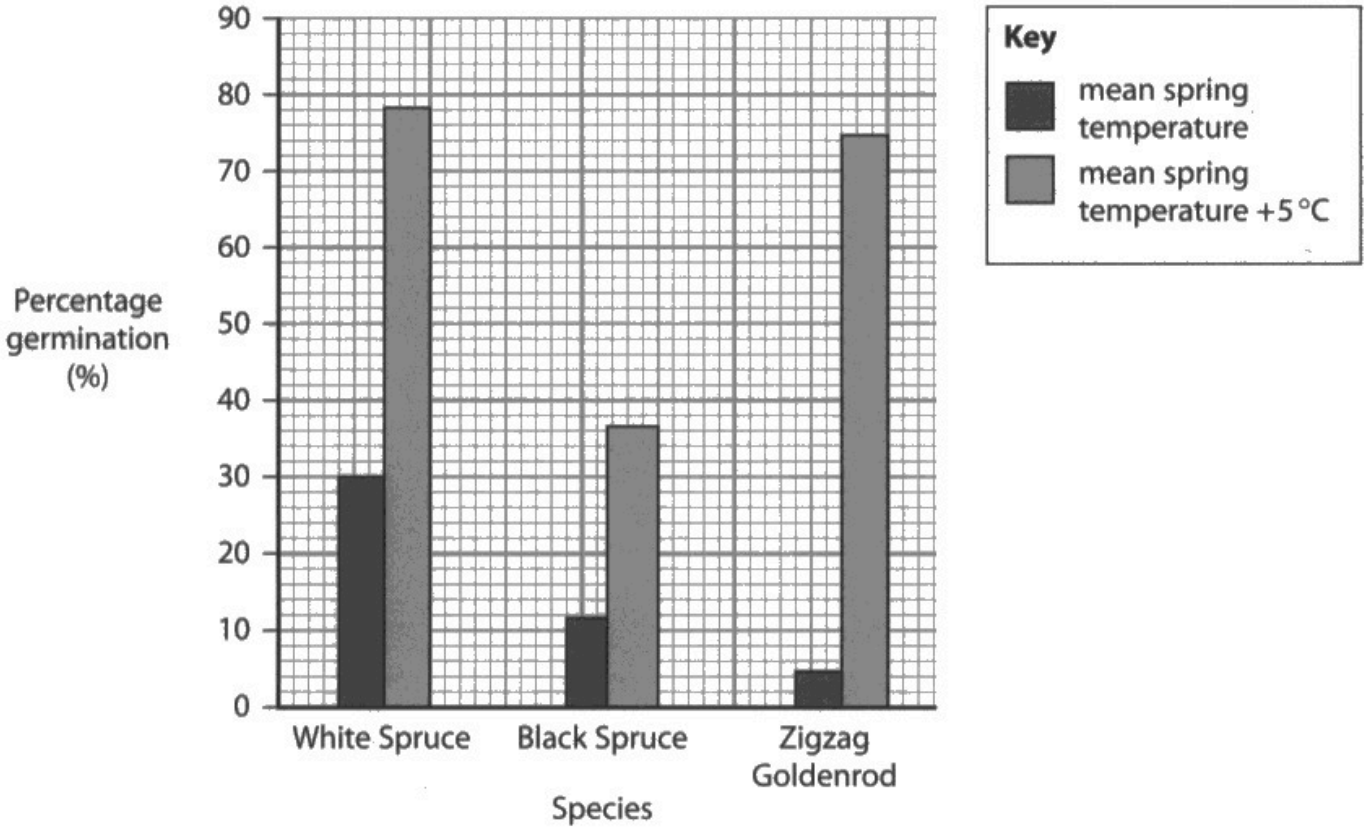
ResultsPlus
Examiner Tip

When asked about data, be clear whether you are referring to all or some of it.

(b) The starch in seeds is broken down by enzymes during germination.

An investigation into the effect of temperature on germination was carried out using seeds from three species of North American woodland plants.

The percentage germination of these seeds at the mean spring temperature for these woodlands was compared with an increase of 5 °C.



(i) Explain the effect of an increase in temperature on germination of these seeds.

(3)

The effect of an increase in temperature on germination of these seeds is that it sped up the cycle of seed germination because of the increased 5°C. Because the enzymes can work at a higher capacity due to increased energy due to the temperature increase. This leads to starch being broken down faster than it would be at a lower temperature leading increased germination rates of the seed species.

ResultsPlus
Examiner Comments

This response achieved mp1 and mp3; 'these seeds' was taken from the question and so assumed they are referring to all three. Reference to starch being broken down faster is our mp3.

ResultsPlus
Examiner Tip

Think about whether you mean more or faster – this question needs the idea of faster.

Question 6 (b)(ii)

This question provided a challenge to candidates as they had to consider distribution changes. Many candidates defaulted to referring to abundance rather than distribution. Additionally, candidates infrequently recognised that climate change can also affect rainfall patterns and so mp2 was rarely seen. When it was awarded, it was for the change in distribution of plants. Candidates frequently referred back to the data provided on the seeds (although not required to do so) and referred to the increase in germination which was in the addition guidance for this question.

(ii) Global warming can result in climate change.

Describe how climate change could affect the distribution of plants in woodlands in North America.

(2)

Climate change can affect seed dispersal methods. Seeds may germinate further north in North America as the poles become ~~warmer~~ warmer, making them more suitable growing conditions for trees.

ResultsPlus
Examiner Comments

This response achieved mp1.

ResultsPlus
Examiner Tip

Remember climate change is not just about increase in temperatures; it can be about changes in rainfall patterns too.

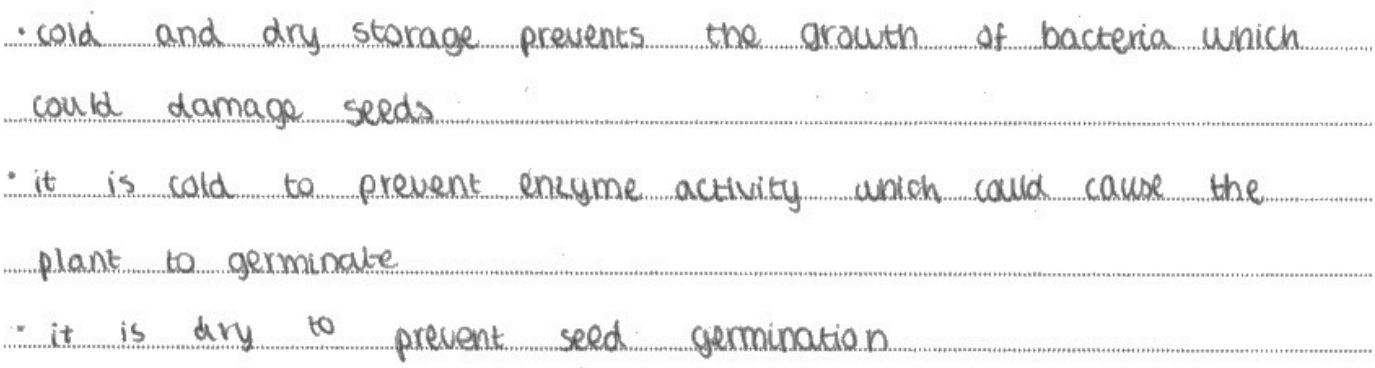
Question 6 (c)

This was well answered by the majority of candidates achieving all three available marks. Some candidates lost out on mp1 as they referred to photosynthesis happening in seeds.

(c) To conserve plant species, seeds may be stored in seed banks.

Explain why cold and dry conditions are required for the storage of these seeds.

(3)



ResultsPlus
Examiner Comments

This response clearly demonstrates all of the marking points.

ResultsPlus
Examiner Tip

Use bullet points where it helps structure your response and be guided by the marks available to know how many distinct points to make.

(c) To conserve plant species, seeds may be stored in seed banks.

Explain why cold and dry conditions are required for the storage of these seeds.

(3)

Plants require warmth and ~~damp~~ moisture to be able to germinate so keeping them in cold and dry conditions prevents the seeds from germinating

ResultsPlus
Examiner Comments

This response achieves mp1.

ResultsPlus
Examiner Tip

Remember 3 marks means 3 distinct points need to be made.

Question 7 (a)(ii)

Candidates were frequently able to identify that the two different species occupied a different niche in the habitat and went on to say this meant there was no competition for resources. Common errors were to refer to the two species having the same niche, could reproduce together to produce fertile offspring, there was no intraspecific competition, or no competition was unqualified.

(ii) In the wild, several species of deer can live in the same area.

Explain why these deer can live in the same area.

(2)

- The different species of deer occupy different niches within the habitat
- They have different roles within the habitat and exploit it in different ways
- There will be no competition between the species, and one species will not outcompete the others, leading to them

ResultsPlus Examiner Comments

Just mp1 achieved here. The response refers to no competition, but it has not been qualified.

ResultsPlus Examiner Tip

When referring to competition (or lack of) between (or within) species, remember to say what they are competing for.

(ii) In the wild, several species of deer can live in the same area.

Explain why these deer can live in the same area.

(2)

the deer occupy different niches so they do not compete with one another for food and resources.

ResultsPlus
Examiner Comments

This response clearly illustrates both of the mark points.

ResultsPlus
Examiner Tip

Remember to qualify what they might (or might not) be competing for.

Question 7 (b)(i)

This question proved a challenge for candidates as they did not process the information correctly. The most common error was associated with the need to take the square root of values or to not complete the final step of the calculation.

(i) The colour of the coats of deer is controlled by a single gene.

The allele for brown coats is dominant and the allele for white coats is recessive.

Calculate the number of heterozygotes in this population using the Hardy–Weinberg equation.

$p^2 + 2pq + q^2 = 1.0$

(3)

250 + 550 = 800

$\frac{250}{800} = \frac{5}{16} = q^2$ $q = \sqrt{\frac{5}{16}} = 0.559$

$p + q = 1$

$1 - 0.559 = p = 0.441$

$2 \times 0.441 \times 0.559 = 0.493$ $0.493 \times 800 = 394$

Answer 394

ResultsPlus
Examiner Comments

This response clearly illustrates all three of our mark points.

(i) The colour of the coats of deer is controlled by a single gene.

The allele for brown coats is dominant and the allele for white coats is recessive.

Calculate the number of heterozygotes in this population using the Hardy–Weinberg equation.

$$p^2 + 2pq + q^2 = 1.0$$

(3)

$q^2 = \frac{250}{800} = 0.3125$

$q = \sqrt{0.3125} = 0.559017...$

~~$p =$~~ $p + q = 1$

$p = 1 - q$

$p = 0.440982...$

$2pq = 0.493$

Answer 0.493

ResultsPlus
Examiner Comments

This response achieved 2 marks. They have not quite completed the calculation.

ResultsPlus
Examiner Tip

Remember to show your working – if you write an incorrect final answer, you may still be awarded working marks.

Question 7 (c)

This question was well answered, showing that candidates have carried out and understood the practical. All mark points were seen although mp2 was least frequent; it was sometimes attempted but the number of samples was too low, or the size of the quadrat was not suitable with some being several metres long/wide, perhaps getting confused with the size of the entire area they were sampling. Some candidates referred to working out percentage cover which is not appropriate for this context where a quantitative value was required for comparison. Again, clarity was sometimes lacking with candidates not distinguishing clearly between mp3 and mp4 in some cases.

(c) A study has shown that grazing by deer reduces plant biodiversity in an area.

An area with a large population of deer was compared with an area from which deer were excluded.

Devise a procedure that could be used to measure plant biodiversity in these two areas.

(4)

A transect could be used to divide within each area, two tape measures could be laid out at/a perpendicular to each other, each measuring 20m. A random number generator could be used ~~or~~ to generate 20 sets of coordinates. A quadrat could be placed at each set of coordinates picked out, counting how many species are present, and the number of individuals of each species. Using this data the biodiversity can be calculated using the index of diversity $\left(D = \frac{N(N-1)}{\sum n(n-1)}\right)$ where N is the total number of organisms of all species and n is the total no. of organisms of each species. The above method can be repeated in the other area, and the diversity indexes compared.

ResultsPlus
Examiner Comments

This response clearly illustrates mp1, mp3, mp4 and mp5 for the maximum four marks.

ResultsPlus
Examiner Tip

Make sure you are clear with what you are counting, measuring or calculating.

(c) A study has shown that grazing by deer reduces plant biodiversity in an area.

An area with a large population of deer was compared with an area from which deer were excluded.

Devise a procedure that could be used to measure plant biodiversity in these two areas.

(4)

two

~~Set up~~ Decide on ~~2~~ pieces of land (one affected by deer and one not). Set up 5 transect belts in each area ~~and~~ & every 10m or 100m and record the ~~spe~~ ~~spec~~ species and number of species at each point. Compare both sites and find out which site has the ~~most~~ highest biodiversity (number of different species).

Biodiversity is the number of different species in an area

ResultsPlus
Examiner Comments

Just mp3 awarded here. The candidate has got muddled with systematic sampling.

ResultsPlus
Examiner Tip

Make sure you know when to do systematic sampling and when to do random sampling.

Question 8 (a)(ii)

This was a generally well answered response. The missed detail was variable across all mark points. Candidates should be prepared to describe processes in detail when they are asked to recall information.

(ii) Describe the role of ribosomes in the synthesis of lactase. (3)

Ribosomes attach to mRNA and free flowing complimentary anticoden/triplets that are attached to amino acids bind and the amino acids link - ribosome goes along creating an amino acid chain that is then turned into a protein in the RER

ResultsPlus Examiner Comments

Just mp1 here. The response almost gets mp2 but doesn't refer to the anticodons associating with the codons and doesn't mention the amino acids linking by peptide bonds for mp4.

ResultsPlus Examiner Tip

Remember to include key terms to give the correct detail.

(ii) Describe the role of ribosomes in the synthesis of lactase.

(3)

- ribosomes are the site of ~~transcription~~ translation of the lactase mRNA which was synthesised in the nucleus
- the ribosome ~~moves down the~~ binds to the mRNA and moves down it, allowing tRNA to bind to the codons on the mRNA with its complementary anticodons
- tRNA then detaches and peptide bonds form between adjacent amino acids and the ribosome moves along the mRNA chain until it reaches a stop codon at which point a polypeptide chain has been formed and thus the primary structure of lactase has been formed.

ResultsPlus
Examiner Comments

This response clearly illustrates all of the mark points.

Question 8 (b)(i)

Generally, candidates were able to achieve both mark points on this question. Those that did not do this were often because they divided by the wrong value. It was essential that the 0.644 value for mp1 was seen in responses in the event the final value was incorrect; it was not sufficient just to see 0.740 – 0.096. Since number of decimal places or significant figures was not specified, any number was accepted although had to be rounded correctly; some were not.

(b) In most mammals, the production of lactase enzyme decreases when the offspring stop feeding on milk.

In Europe, a single mutation resulted in the continued production of lactase enzyme by children and adults.

The study recorded changes in the frequency of this mutation over the past 4000 years.

Time, years ago	Frequency of mutation allowing lactase production into adulthood	
	UK	Central Europe
4000	0.096	0.079
3000	0.280	0.093
2000	0.680	0.250
1000	0.770	0.590
0 (Present)	0.740	0.440

(i) The frequency of this mutation in Central Europe has increased by 457% in the last 4000 years.

Calculate the percentage increase in the frequency of this mutation in the UK in the last 4000 years.

(2)

$0.740 - 0.096 = 0.644$

$\frac{0.644}{0.740} \times 100 = 87.027$

~~= 487% increase~~

487% increase

522.162%.

487%.

~~522.162~~ ..... %

ResultsPlus
Examiner Comments

This response achieves mp1 for showing the first part of the calculation correctly with the 0.644 clearly written. The second part has used the wrong number and so the final answer is incorrect, meaning mp2 cannot be awarded.

ResultsPlus
Examiner Tip

Show your working! This includes intermediate 'answers' – ie. don't just write out the calculation and do it all in one go. Take a step-by-step approach.

(b) In most mammals, the production of lactase enzyme decreases when the offspring stop feeding on milk.

In Europe, a single mutation resulted in the continued production of lactase enzyme by children and adults.

The study recorded changes in the frequency of this mutation over the past 4000 years.

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(i) The frequency of this mutation in Central Europe has increased by 457% in the last 4000 years.

Calculate the percentage increase in the frequency of this mutation in the UK in the last 4000 years.

(2)

UK

4000 0·096

0 0·740

0·740 − 0·096 = 0·644

$\frac{0·644}{0·096} \times 100 = 670·83$

~~670~~

671 % (3sfs)

671 %

ResultsPlus
Examiner Comments

This candidate has the correct final answer so can be awarded both mark points. Note the clear setting out of the working.

Question 8 (b)(ii)

Those candidates that recognised this as a natural selection story were generally able to score well. It was pleasing to see candidates consistently referring to advantageous alleles rather than genes as has been the case in previous seasons. The misconception of the selection pressure causing the mutation is still apparent in a number of responses. Some candidates missed the story completely and described the data between the UK and Central Europe.

(ii) During the last 4000 years, changes in farming led to a greater increase in the consumption of milk and dairy products in the UK compared with Central Europe.

Many children and adults in Europe have a mutation that allows continued production of lactase enzyme.

Comment on the effect of consuming milk and dairy products on the change in the frequency of this mutation.

(4)

An increase in the consumption of milk and dairy products has led to a mutation allowing continued production of lactase enzyme. This is because lactase breaks down lactose, which is present in milk and dairy products. Lactase is a favourable meaning the allele responsible for producing continued lactase is favourable as it is advantageous. This means its frequency in the gene pool has increased, resulting in more people having this mutation.

ResultsPlus
Examiner Comments

This response achieved mp2. The reference to the allele increasing in the gene pool does not have any indication of over time and so mp4 cannot be awarded.

ResultsPlus
Examiner Tip

When asked about changes in frequency of alleles or mutations, consider whether the natural selection story can be applied to the context.

(ii) During the last 4000 years, changes in farming led to a greater increase in the consumption of milk and dairy products in the UK compared with Central Europe.

Many children and adults in Europe have a mutation that allows continued production of lactase enzyme.

Comment on the effect of consuming milk and dairy products on the change in the frequency of this mutation.

(4)

~~Genetic~~ There was genetic variation in the population due to the mutation allowing continuous lactase production. The selection pressure was an increase in lactose (found in milk and dairy products) consumption. This means that those with the advantageous allele for continued lactase production were more likely to survive and reproduce to pass on the advantageous allele to their offspring, increasing the ~~allele~~ mutated allele frequency over many generations.

(Total for Question 8 = 10 marks)

ResultsPlus
Examiner Comments

This response clearly illustrates all the mark points available.

ResultsPlus
Examiner Tip

Write the story in a logical sequence but apply the context given to it.

Question 9 (a)(i)

This question was well understood with many candidates achieving maximum marks. Where marks were lost it was usually due to lack of clarity in the response or for the killing of viruses which is not accepted.

9 Hepatitis C is a virus that can infect the liver.

In some children, hepatitis C can cause serious liver damage.

(a) After infection with hepatitis C, many people experience a fever.

(i) Explain the role of a fever in the immune response.

(2)

A fever will increase the internal temperature of the person, and this is used in the immune response to try and destroy pathogens, as the high temperature may cause enzymes to denature in the pathogen, meaning they cannot survive as their metabolic reactions stop.

ResultsPlus
Examiner Comments

This response clearly scores the maximum marks available.

9 Hepatitis C is a virus that can infect the liver.

In some children, hepatitis C can cause serious liver damage.

(a) After infection with hepatitis C, many people experience a fever.

(i) Explain the role of a fever in the immune response.

(2)

A fever increases the bodies core temperature to a point where enzymes begin to denature which will kill off an infection such as hepatitis C.

ResultsPlus
Examiner Comments

This response achieves mp1 but did not achieve mp3 as it was not clear which enzymes were being referred to. There is no credit for killing the Hepatitis C as viruses cannot be killed.

ResultsPlus
Examiner Tip

Be clear what cells you are referring to.

Question 9 (a)(ii)

Candidates have clearly learnt this process as they were able to give a good level of detail. Some wasted valuable time, going into detail about how the T helper cells were activated. Those that lost marks were due to confusion when trying to write mp2 and mp3; candidates were often not clear which cells the B cells were producing. Some candidates thought the B effector cells produced the antibodies.

(ii) Individuals infected with hepatitis C produce antibodies.

Describe how the activation of T helper cells leads to the production of antibodies.

(4)

X T-helper cells release substances that activate B-cells and T-killer cells. B-cells are activated when they binds to complementary antigens on an antigen presenting cell. This causes B-cells to divide by mitosis into plasma cells, which produce antibodies that kill invading cells.

ResultsPlus
Examiner Comments

This response achieved mp4.

(ii) Individuals infected with hepatitis C produce antibodies.

Describe how the activation of T helper cells leads to the production of antibodies.

(4)

A macrophage will engulf the pathogen and present the pathogen on ~~the~~ its surface, making the macrophage an APC. As T helper cells bind using complimentary CD4 receptors, they are activated and release cytokines. These cytokines activate B cells which differentiate into plasma cells and plasma cells produce antibodies. Memory B cells will be produced afterwards. Cytokines also activate T killer cells.

ResultsPlus
Examiner Comments

This response achieves mp1, mp3 and mp4. They describe activated B cells differentiating into plasma cells for mp3.

ResultsPlus
Examiner Tip

Make sure you know the names and roles of all the different types of cells in the immune response.

Question 9 (b)

This question required candidates to apply their knowledge of HIV to the hepatitis C virus. It was clear that some candidates had learnt this area of the specification well and were able to achieve all three mark points. Those that did not often muddled up infection by prokaryotic cells with viral infection or referred to T helper cells. Candidates should be reminded to ensure they use terminology correctly, particularly with the structure of a virus. Other candidates tended to write about how the virus replicated once it was inside the host cell.

(b) Hepatitis C enters liver cells and destroys them.

The virus causing hepatitis C has a similar structure to HIV. It is an RNA virus with a lipid envelope and glycoproteins.

Deduce how the hepatitis C virus is able to enter liver cells.

(3)

Hepatitis C has attachment proteins which are used to latch onto liver cells. It then inserts its viral RNA into liver cells where it then uses reverse transcriptase to turn viral RNA into DNA, becomes part of the hosts DNA sequence Produces more viral Proteins. Hepatitis C causes cell lysis in order to spread more of itself to surrounding cells.

ResultsPlus
Examiner Comments

This response achieves mp3.

ResultsPlus
Examiner Tip

Think about something you have learnt in a similar context and see if it could be applied here.

(b) Hepatitis C enters liver cells and destroys them.

The virus causing hepatitis C has a similar structure to HIV. It is an RNA virus with a lipid envelope and glycoproteins.

Deduce how the hepatitis C virus is able to enter liver cells.

(3)

- ~~The~~ Hepatitis C will have glycoproteins on its surface. these bind to the liver cell receptors on its membrane. Its lipid envelope fuses with the liver cell surface membrane. It releases its RNA into the liver cell.
- RNA can turn into DNA by reverse transcriptase., using integrase.

ResultsPlus
Examiner Comments

This response illustrates all of the mark points.

ResultsPlus
Examiner Tip

Remember to use key terminology correctly – the virus has a lipid envelope, not a cell membrane!

Question 9 (c)

This question required candidates to use stimulus material to discuss different treatments of hepatitis C. The full range of marks was seen although most candidates achieved a level 2. Candidates should be reminded they need to apply their own knowledge to any stimulus material in these questions in order to go beyond level 1; it is not sufficient to simply re-write the information already given as this will not be credited. Many candidates were able to give extensive detail on the way the vaccination works at the expense of the other forms of prevention/treatment. There was a significant misconception surrounding the use of the antibodies, with candidates indicating that this can lead to an immune response and the production of memory cells. Candidates were able to discuss the ease of administration well and could usually identify how the drugs would work. A minority of candidates were able to offer level 3 sustained responses.

Discuss the use of these different hepatitis B treatments.

(6)

The 2 drugs are given after an individual has been injected with Hepatitis B. Entecavir is easily taken as a tablet so is a simple treatment to take and it inhibits the viral polymerase of the virus. This means it is unable to bind to the RNA and copy the genetic material this reduces replication of the virus. Interferon works in a similar way given weekly so doesn't have to be done daily however the procedure of an injection is more complicated and more adverse. However interferon also prevents RNA viral replication it can bind to ribosomes to stop translation. It can also help by binding to receptors on T-helper and other white blood cells to reduces the viruses ~~grow~~ binding and injection their genetic material and it being copied by host cell. Interferon can also promote the over bodies specific immune response to all helping to reduce viral replication and destroy the virus in the body.

Other 2 treatments are given as a preventative measure which is helpful in stopping hep B in the first place. The antibodies given to babies is artificial passive immunity which can help the baby reduce rash and agglutinate the viruses fast to stop infection ~~however~~ so it acts quickly and can keep the baby safe however it doesn't provide any long term protection from the virus itself.

The vaccine provides artificial active immunity and is 95% effective in long term protection this treatment is most productive as it enables a primary immune response in the body enables memory B and T cells to be produced without having ill as the vaccine is an attenuated virus. This means if injected in the future less likely to become unwell as the sending response is much faster due to presence of memory cells and antibodies so stops infection and provides long term protection from hepatitis B

(Total for Question 9 = 15 marks)

ResultsPlus
Examiner Comments

This response achieved level 3; there is extensive discussion from all three areas of the mark scheme.

ResultsPlus
Examiner Tip

Use stimulus material but extend it with your own knowledge and write 'a little about a lot'. This does not mean the 'little' should be superficial knowledge!

Discuss the use of these different hepatitis B treatments.

(6)

The use of drugs can be effective if taken at the correct dosage and for the correct length of time. While taking the drug, the body may become resistant. This means that if treatment is stopped to early, or if the patient forgets to take the tablet one day, the resistant virus will continue to replicate.

The use of antibodies will be most effective for newborns. A one time injection of antibodies will be much more managable than a dose of drugs. It will also prevent the child from developing the liver disease from Hepatitis B as the body will have memory cells present ineeise of secondary immune response being required.

The three doses will also be effective in the Prevention of development as it also allows the body to produce memory cells which can be activated if the person becomes infected at a later date.

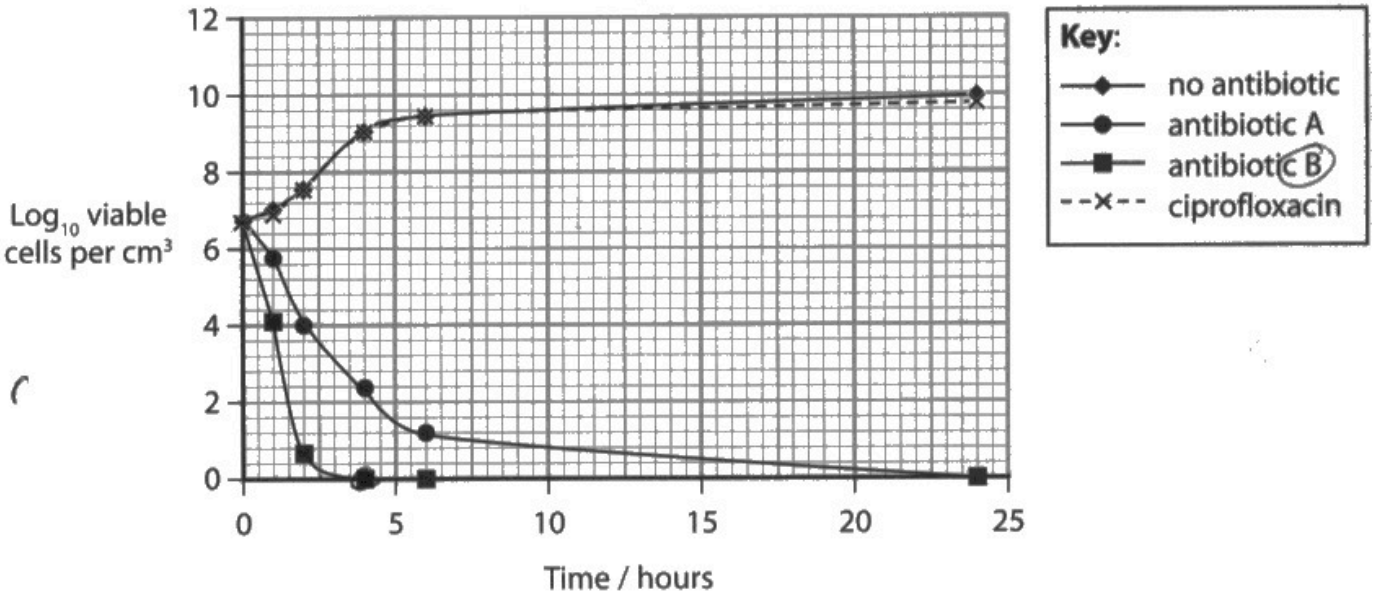
ResultsPlus
Examiner Comments

This response achieved level 1 – there are some biological inaccuracies, and it only addresses ease of administration and production of memory cells by vaccination.

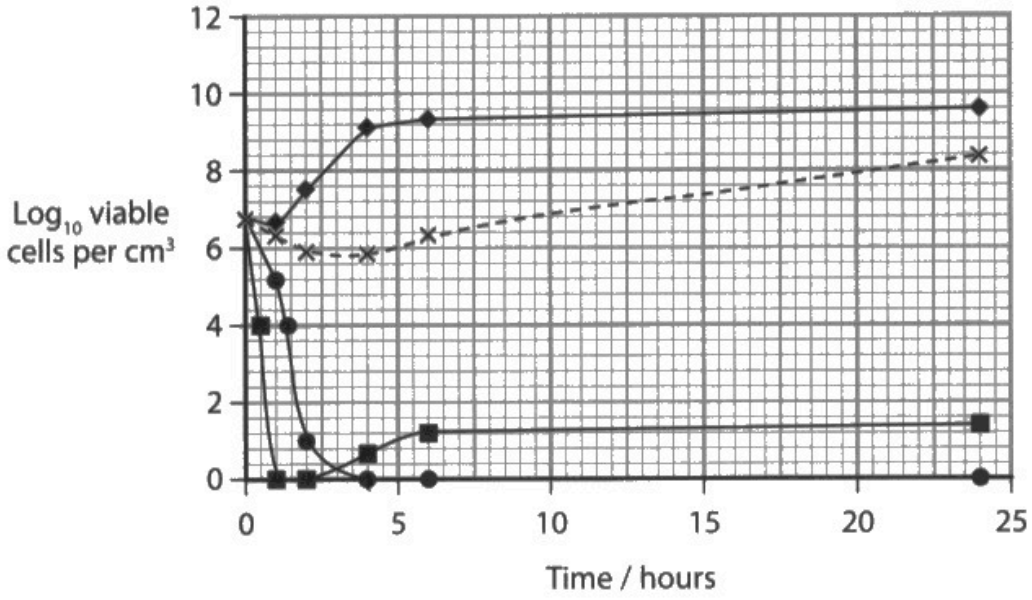
Question 10 (b)(i)

This question required candidates to read a value from a log graph and take the antilog before calculating a rate. Most candidates simply read the value from the graph, did not take the antilog and then calculated the rate, yielding an answer of 1.7; this was awarded one mark. Unusually, we did not expect candidates to provide any units for their responses and so any provided were ignored. Very few candidates recognised the need to take the antilog and calculate the correct answer.

Bacteria species P



Bacteria species Q



(i) Calculate the mean rate of decrease in the number of cells in the first four hours for species P for antibiotic B.

(2)

$$\frac{6 \cdot 8 - 0}{0 - 4} = -1 \cdot 7$$

Answer 1.7

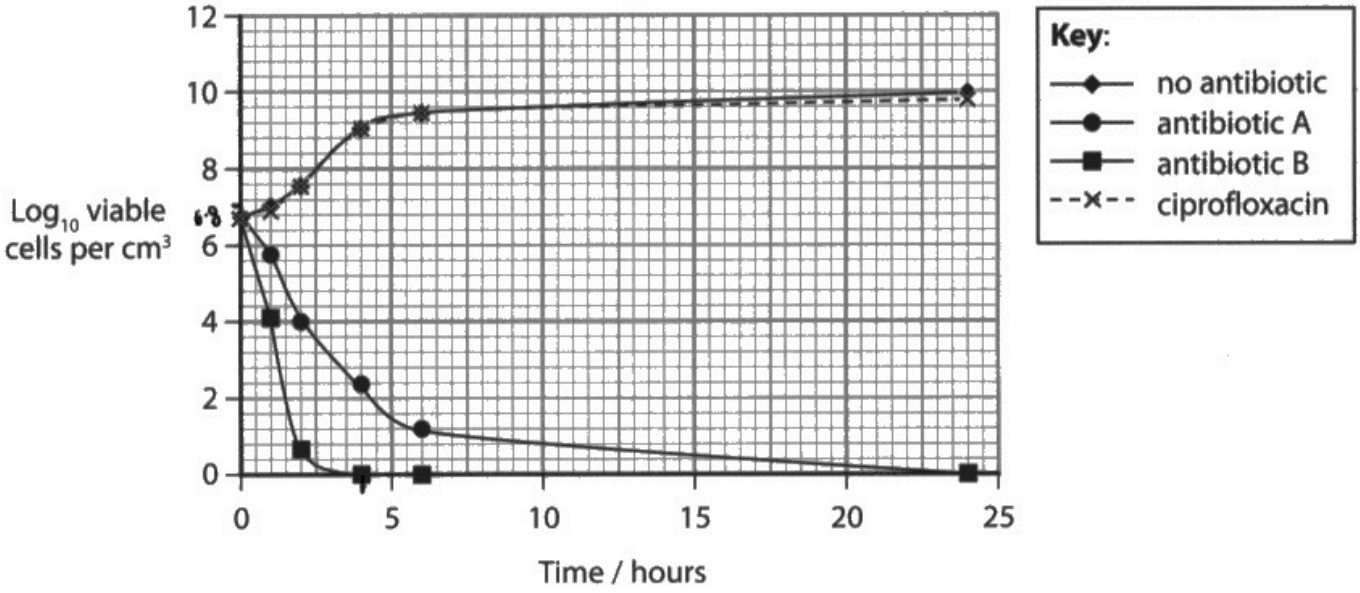
ResultsPlus
Examiner Comments

This response achieved the ECF mark.

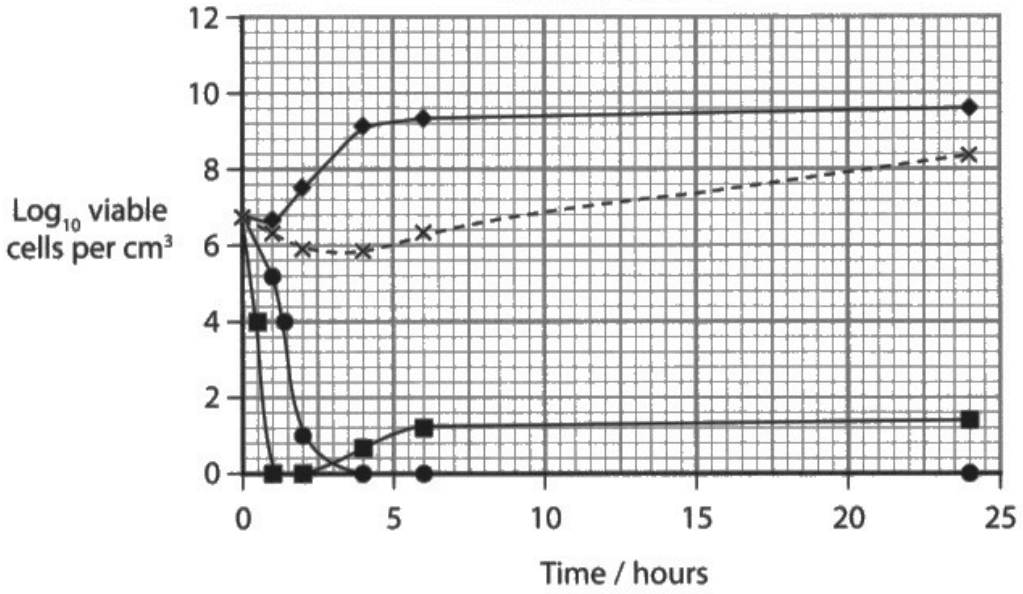
ResultsPlus
Examiner Tip

Remember to take the antilog if you are presented with a graph with a log scale – make sure you know how to do this on **your** calculator before your exams!

Bacteria species P



Bacteria species Q



(i) Calculate the mean rate of decrease in the number of cells in the first four hours for species P for antibiotic B.

(2)

$\log_{10} x = 6.8$

$$\frac{6309573.445}{4} = 1577000$$

Answer decrease of 1577393 viable cells per cm³ per hour

ResultsPlus
Examiner Comments

This candidate was one that achieved the final correct answer, scoring both marks.

Question 10 (b)(ii)

This question required candidates to make comments on the effectiveness of two antibiotics against two species of bacteria. Some candidates didn't read the question carefully enough and included ciprofloxacin in their response which muddied their response. Candidates were generally able to achieve mp1 and/or mp2; sometimes they contradicted themselves meaning they lost the mark. Candidates often assumed that the re-appearance of one of the species after a period of time was because of the development of resistance but failed to observe that the numbers remained too low for this to be the case.

(ii) Comment on the effectiveness of antibiotics A and B against both species of bacteria.

(4)

A and B are both effective against species P. B is slightly more effective as it reduces cell number of P at a greater initial rate. It takes B less than 5 hours to totally kill P, whereas it takes A 24 hours. Both are more initially effective against Q than P. A keeps the Q number at 0 whereas B allows bacteria to multiply and increase in number again. So B is not the superior antibiotic for Q treatment. As may be bacteria A and B are bactericidal as they decrease the number of bacterial cells. Q may have developed resistance to B quickly, allowing it to continue to multiply.

ResultsPlus
Examiner Comments

This response achieves mp1 in the first two lines, mp3 on the fourth line and mp2 at the end of the first paragraph.

(ii) Comment on the effectiveness of antibiotics A and B against both species of bacteria.

(4)

- Species Q wasn't resistant to ciprofloxacin so may have had multiple strains present.
- Both A and B were effective on species P
- Rate of decrease of P by A an B was slower than Q
- Rate of decrease of ~~Q~~ Q by A and B is alot faster.
- A works very well.
- However cells of Q start to rise after 6 hours and stay at a constant number meaning resistance has developed.

ResultsPlus
Examiner Comments

This response did not score any marks as they are simply describing the data without making final comments as directed in the question.

ResultsPlus
Examiner Tip

Don't just describe the data that the examiner can already see if you are asked to comment on it. You will need to make a further statement.

Question 10 (b)(iii)

Of the two extended response questions, this one was more confidently answered by candidates, generally. This question required candidates to use their knowledge of a core practical to describe how to identify the optimum concentration of two different antibiotics. Many candidates were able to give good detail, but examples of missing information included:

- detail of standardised incubation times; candidates were able to either give the temperature or the time. Often the time was not realistic with examples ranging from a number of hours to weeks.
- what it was they were measuring ie. the diameter of the zone of inhibition and then following this, calculating the area.
- reference to ensuring volumes of bacteria added being constant.

Many candidates also referred to the optimum dose as the one with the largest zone of inhibition, rather than the lowest concentration with the largest.

*(iii) A further investigation found the optimum concentration needed to kill bacteria for each of the new antibiotics using cultures on agar plates.

Devise a procedure that could be used to find the optimum concentration for each antibiotic.

(6)

IV: concentration of each antibiotic; 10, 20, 30, 40, 50, 60, 70, 80%

DV: zone of inhibition, create multiple agar ~~gel~~ lawn plate and lawn with bacteria P ; ~~pour~~ leave to dry and then create wells (one on each plate) and pour inside 3cm^3 of the antibiotic), tape shut ~~ed~~ (not airtight) and incubate at 37°C for 48 hours, then measure the diametre of the zone of inhibition and use it to calculate the area using πr^2

CV: temperature and time of storage, spread of bacteria, use sterile agar plates to prevent other bacteria being present, volume of antibiotic

repeat with the two new antibiotics, and repeat 5 times at each conc. to calculate a mean, use Spearmans Rho to ~~see~~ test for significant correlation, plot on line graph and see where zone of inhibition starts to plateau, the point before is the optimum temp, the larger the zone of inhibition, the more effective that concentration of bacteria is.

ResultsPlus
Examiner Comments

This response achieved a level 3 score. They have given good detail and also made clear statements regarding choosing the lowest concentration with the largest zone of inhibition.

*(iii) A further investigation found the optimum concentration needed to kill bacteria for each of the new antibiotics using cultures on agar plates.

Devise a procedure that could be used to find the optimum concentration for each antibiotic.

(6)

Get two separate agar plates for each antibiotic. Label them with the ~~bacteria~~ bacterias names. Then you want to spread the ~~bacteria~~ bacteria onto the separate agar plates with a tool that has been dipped in alcohol / ethanol and dried off using a bunsen burner and warmed. Then place your different concentration of antibiotics at good distances from each other. Leave these agar plates for a few hours and allow the antibiotics to work against the bacteria. Once you have your results you can identify the optimum concentrations needed to kill the bacteria for each of the antibiotics by observing the zones of inhibition around each antibiotic.

ResultsPlus
Examiner Comments

This response achieved a level 1 score. The basic detail is present but there are no linkages such as how the antibiotics are being applied or what it is about the zones of inhibition they are observing.

ResultsPlus
Examiner Tip

When giving a practical method for an extended response question, try to give it in such detail that someone else could read your response and carry out the experiment without asking any questions.

Paper Summary

Based on the performance in this paper, candidates should:

- Read questions more carefully, paying attention to the command word using them to direct the path their response takes
- Use key terms more appropriately
- Avoid paraphrasing the question and repeating themselves in several different ways
- Ensure their response answers the question that is being asked, not the one you want it to ask
- Pay careful attention to instructions in questions, such as significant figures requested
- Carry out common sense checks on mathematical questions.

Grade boundaries

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

https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

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