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Examiners' Report
June 2017

GCE Biology 8BN0 01

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Introduction

The paper was the second of the new specification and tested the knowledge, understanding and application of material from the topics 'Lifestyle, health and risk' and 'Genes and health'. The range of questions provided ample opportunity for candidates to demonstrate their grasp of these topics.

The questions on this paper yielded a wide range of responses and some very good answers were seen; resulting in a good spread of marks. The paper appears to have worked very well with all questions achieving the full spread of marks. Very few questions were left blank and there was no evidence in the vast majority of papers that candidates had insufficient time to complete the paper. For example, nearly all candidates wrote lengthy answers to the last question on the paper.

There were some straightforward questions that yielded high marks across the ability range and some more challenging questions that discriminated well. It was very pleasing to see such large numbers of excellent responses which were clear and comprehensive, showing a good use of appropriate biological terminology. The responses to Question 6(b)(i) in particular, were very well structured, used the correct terminology and were therefore high scoring.

It was clear that some candidates do not always read the command words carefully enough and ignore information provided in the question. Therefore they drop straightforward marks by not answering appropriately – for example, describing instead of making comparative statements in 'compare and contrast' questions.

Questions that demanded recall tended to score very well. However, when asked to analyse and explain data and apply their knowledge to unfamiliar contexts, many candidates found the marks harder to obtain.

It was evident that some areas of the specification are better understood than others. The application of knowledge regarding DNA replication, molecule structure and effect of temperature/pH on proteins proved more challenging, catching out some who had learnt a particular stock answer and were not able to apply their knowledge to the given scenario and information.

Question 1 (a) (i)

Question 1(a) was designed to examine knowledge and ideas relating to the first core practical.

The majority of candidates answered (a)(i) well, with nearly 85% showing a good understanding of variables that should have been controlled in the investigation.

The most common response was the concentration of the caffeine solution, with temperature being almost as popular.

The most common reason for a mark not being awarded here was the use of the word 'amount' instead of volume.

(i) State **one** variable that should have been controlled in this investigation.

(1)

temperature

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Examiner Comments

This gained one mark for a correct variable that should have been controlled in this investigation.

(i) State **one** variable that should have been controlled in this investigation.

(1)

The age of the zebrafish

ResultsPlus
Examiner Comments

This was another response which gained the mark for a correct controlled variable.

Question 1 (a) (ii)

Candidates were asked to analyse the table of data that was provided to justify a conclusion for the investigation into the effect of caffeine on the heart rate of zebrafish.

The vast majority of candidates were able to conclude that the caffeine increased the heart rate of the zebrafish. However, fewer candidates understood the command word 'justify' and did not use the data to support this conclusion. Therefore they did not gain the second marking point.

(ii) Analyse the data to justify a conclusion for this investigation.

(2)

The data shows that the heart rate of the zebrafish in caffeine was higher than the heart rate of the zebrafish in water on every repeat showing caffeine increases heart rate in zebrafish.

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Examiner Comments

This response gave a correct conclusion for the investigation, that the caffeine increased heart rate, but did not support this by stating a quantified increase. Therefore they were awarded one mark.

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Examiner Tip

If you say one variable has caused the dependent variable to increase – then calculate how much it has increased by.

The average heart rate for water was 118.7 bpm. In caffeine the average increased to 170.7 bpm, about a 40% increase. Therefore it could be concluded that caffeine increases the heart rate of zebrafish.

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Examiner Comments

This response gained one mark for correctly stating that caffeine increased heart rate. However, 'about a 40% increase' was not specific enough to be awarded the second mark.

The data shows that on average, the zebrafish's heart rate 118.6 bpm to 170.6 bpm, an increase of 43.8% on average. This means that caffeine can be shown to increase the heart rate of the zebrafish

ResultsPlus
Examiner Comments

This response gained full marks as the candidate analysed the data to give a correct conclusion and supported their conclusion with a correct quantified statement.

Question 1 (a) (iii)

The majority of candidates were able to use the information provided by both the question and the image of the zebrafish to answer this question. They linked the idea that the zebrafish had a transparent body to the idea that the picture showed that the heart was visible.

A few candidates did not use the information provided in the diagram and relied on their knowledge from core practical one. Their answers tended to focus on the idea that a dissection would not be required.

A surprising number of candidates did not use the information provided and focused on the idea that the zebrafish were young and therefore were less likely to have heart conditions and therefore scored 0 marks.

Very few answers gained marks for the alternative answer that the zebrafish was an aquatic organism and therefore could take in the caffeine from the solution.

(iii) Explain the advantages of using young zebrafish for this investigation.

(2)

They are transparent allowing their hearts to be easily visible under a light microscope. They are small so they can be easily placed on a cavity slide and viewed under a light microscope.

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Examiner Comments

This was a well-written answer which covered all the aspects needed to gain full marks.

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Examiner Tip

Use all the information provided to you in the introduction to questions.

there is unlikely to be any influence from heart problems (CVD). As older zebrafish may have heart which are dysfunctional due to diseases causes by old age (young zebrafish have healthier hearts).

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Examiner Comments

This answer focused on the word 'young' in the question and did not use the idea of the heart being visible from the image provided.

- the zebrafish is transparent, this makes the ~~overs~~ observation easier.

- zebrafish has a ~~more~~ simple body structure ~~heart~~ → less conditions will affect the observation.

ResultsPlus
Examiner Comments

This response correctly recognised that the zebrafish was transparent, but lost the second mark as it did not explain why this would be an advantage for the experiment.

Question 1 (a) (iv)

This was surprisingly poorly answered by many candidates. Many did not recognise that zebrafish were vertebrates, despite the labelling on the diagram. When some candidates did correctly state that zebrafish were vertebrates, they often did not go on to explain why this would cause a different ethical issue to using invertebrates.

Two common answers given by many candidates were that Daphnia were bred for fish food or that they were more abundant than zebrafish. The answers suggested that this meant there were less ethical issues relating to their use in the experiment.

(iv) Give **one** reason why a different ethical issue has to be considered when using zebrafish instead of *Daphnia* in this investigation.

(1)

They may not be abundant therefore using them in the experiment will ~~not~~ affect the species as a whole.

ResultsPlus
Examiner Comments

This was not an appropriate ethical issue and therefore no mark was awarded.

Zebrafish are vertebrates, while Daphnia are invertebrates. ~~Vertebrates~~ This means the Zebra fish are more closely ~~to~~ related to us than Daphnia

ResultsPlus
Examiner Comments

This was a common response. They have correctly recognised that zebrafish are vertebrates but have not explained why this would cause a different ethical issue.

Question 2 (a) (ii)

Question 2 related to the specification point 2.1 and as such required candidates to relate how the rate of diffusion depends on the properties of gas exchange surfaces in living organisms. Knowledge of Fick's Law of Diffusion was also required.

Around a quarter of candidates did not gain any marks on Question 2(a)(ii) as they either did not read the information provided or they lacked precision in their answers. Candidates needed to pick up on the information at the start of the question about the organism being single celled. A significant number of candidates did not and referred to the gas exchange surface being one cell thick. References to 'gases' entering the cell by diffusion were not specific enough; the idea of oxygen was required.

The most common marking point awarded was the mark for the organism having a large surface to volume ratio.

(ii) Describe why single-celled organisms, such as *Valonia ventricosa*, do not need a specialised gas exchange surface.

(2)

The single-celled organisms have a large surface ~~area to~~ area to ~~volume~~ volume ratio. The metabolic rate is low and the demand for energy is little. Diffusion will be fast enough to supple the organelles in the single-celled organism with O_2. So they don't need specialised gas exchange surface.

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Examiner Comments

This is a clear, concise answer which gained the first two marking points.

It has a large surface area to volume ratio, which means diffusion is efficient enough for gas exchange due to the small diffusion distance.

ResultsPlus
Examiner Comments

This answer was awarded one mark for correctly stating that the single-celled organism would have a large surface area to volume ratio. They were awarded the second mark for the short diffusion distance. However, this is an example of where the first marking point would not have been awarded.

Question 2 (b)

In order to gain full marks for this question, candidates needed to consider how the structure of the lungs related to all aspects of Fick's Law in order to have a high rate of diffusion of oxygen or carbon dioxide; large surface area, high concentration gradient and short distance for diffusion.

Many candidates recognised that alveoli have a large surface area but did not include the idea that many alveoli, each having a large surface area, enabled the lungs to have a high rate of gas exchange. Therefore the first marking point was awarded less commonly than was expected.

A surprising number of candidates lost the mark for diffusion distance as they incorrectly stated that capillaries / alveoli are one cell thick. They needed to say that the walls of the capillaries / alveoli were one cell thick.

It was pleasing to see so many good explanations as to how the lungs maintain a high concentration gradient.

(b) Mammalian lungs are adapted for rapid gas exchange.

Explain how the structure of the human lungs enables rapid gas exchange.

(4)

Mammalian lungs contain many alveoli. These alveoli provide a large surface area for diffusion so the rate of gas exchange increases.
Mammalian lungs also have alveoli that have a wall that is one cell thick. This therefore provides a short diffusion distance for the gasses. As well as this, mammalian lungs have a large net work of capillaries surrounding the alveoli. This mean that blood is constantly moving providing a steep concentration gradient for diffusion. So this ensures rapid gas exchange

fycks law states that the rate of diffusion is most efficient when there's a short diffusion distance, steep concentration gradient and a large surface area for diffusion.

ResultsPlus
Examiner Comments

This was an excellent response which gained full marks.

The lungs have many capillaries what provide a large surface area therefore diffusion of oxygen and carbon dioxide can happen quickly. As well as this the thin walls of the capillaries and artery Artenes means that diffusion can happen over a short distance.

ResultsPlus
Examiner Comments

This answer concisely explains how the structure of the lungs enables rapid gas exchange with reference to two aspects of Fick's Law; surface area (for capillaries but not alveoli) and distance for diffusion, and was awarded two marks. Concentration gradient has not been considered.

ResultsPlus
Examiner Tip

Make sure you cover all 4 aspects of Fick's Law in these types of questions.

The lungs have a large surface area due to having many alveoli and many capillaries which increases the rate of diffusion. There is a high concentration gradient in the lungs which is maintained by ventilation of the alveoli and blood flow through capillaries. A high concentration gradient increases the rate of diffusion. There is a short diffusion distance due to the one-cell thick walls of the alveoli and capillaries and ~~the wall~~ flattened cells forming the walls of the alveoli and capillaries. A short diffusion distance increases the rate of diffusion. ~~The membranes~~ The rate of diffusion is proportional to a diffusion constant and the cell membranes are relatively permeable to non-polar gas molecules.

ResultsPlus

Examiner Comments

This was an answer which considered all aspects of Fick's Law and used this in their explanation of how the structure of the lungs enabled rapid gas exchange to achieve full marks.

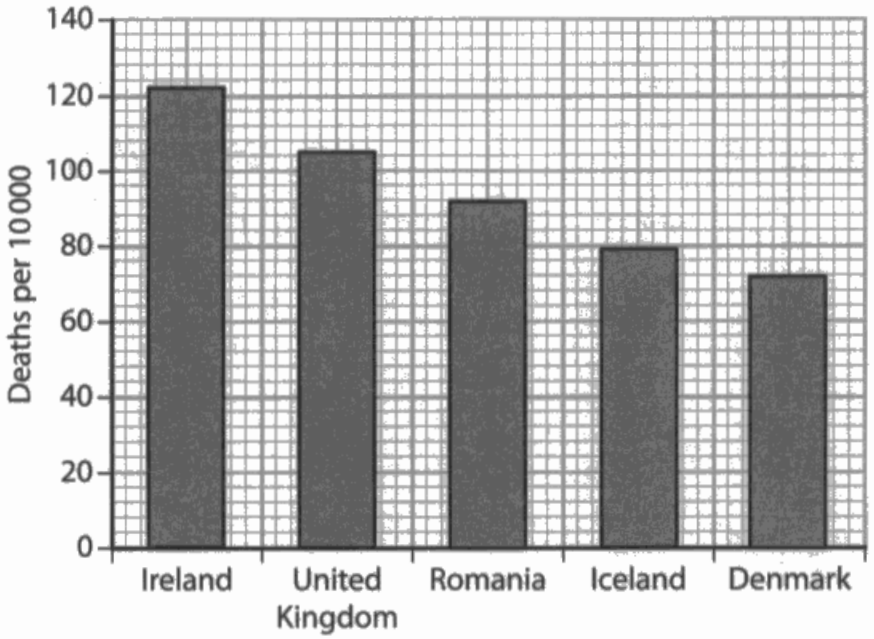
Question 2 (c)

This question was answered correctly by the majority of candidates. They were able to extract the correct information from the data provided and use this to calculate the probability correctly. Most candidates gave the answer as a percentage.

A significant minority of candidates extracted the wrong information from the data provided and therefore scored 0 marks. Another common mistake was either missing units for answers given as a percentage or incorrectly writing a percentage sign for answers that were not a percentage.

It was pleasing to see that candidates were showing their working in the majority of cases.

(c) The graph shows the death rates due to diseases of the respiratory system in some countries.



Calculate the probability of dying from a disease of the respiratory system in the United Kingdom.

(2)

$\frac{105}{10,000} = 0.0105$

Answer 0.0105

ResultsPlus
Examiner Comments

This response shows that the correct numbers have been used to calculate the probability and has gained full marks.

Calculate the probability of dying from a disease of the respiratory system in the United Kingdom.

(2)

Deaths per 10,000 = 104

$\frac{104}{10,000} = 0.0104$

Answer 0.0104%

ResultsPlus
Examiner Comments

This response lost one mark as they incorrectly placed a % sign after their answer. However, one mark could be awarded as they had inserted the correct numbers into the equation.

ResultsPlus
Examiner Tip

Always show your working for calculations – even if your answer is wrong you may show your understanding in stages of the calculation and get awarded some of the marks available.

Question 2 (d)

This was surprisingly poorly answered by many candidates as they did not grasp the concept that the alveoli would have a smaller surface area in people with emphysema or understand the effect this would have on the rate of diffusion.

The most commonly awarded mark was for the idea that a higher concentration of oxygen would result in a larger concentration gradient, but few candidates were then able to explain why this would be beneficial.

Explain why people with emphysema are given air with a higher concentration of oxygen than atmospheric air.

(2)

This is because lungs with emphysema have larger air spaces and so require a higher concentration of oxygen ~~to~~ for the body to function normally. The atmospheric air ~~me to~~ contains less oxygen so in order to meet the demands of people with emphysema, may need a higher concentration of oxygen.

ResultsPlus
Examiner Comments

This response shows a common response – the idea of larger airspaces. They have not been able to relate their understanding of Fick's Law to this given context so gained no credit.

ResultsPlus
Examiner Tip

Always use the correct scientific terminology in your answers.

Because their air spaces are enlarged which means if they had 'normal air' there would be a very low concentration of oxygen in the lungs and therefore gaseous exchange would be very efficient. There is more space for the air to fill and therefore the concentration of the air is largely decreased.

(Total for Question 2 = 11 marks)

ResultsPlus
Examiner Comments

This response shows a common mistake made by candidates. They have not recognised the effect on the surface area of the alveoli. In addition, they are not using the term 'alveoli' which would be expected at this level. Again, no marks were awarded.

As the alveoli in lungs with emphysema have a smaller surface area, the rate of diffusion of oxygen into the capillaries will be less. Therefore diffusion is less efficient. By increasing the concentration oxygen inside the alveoli the concentration gradient will be steeper increasing the rate and efficiency of diffusion. Fick's law states this as diffusion $\propto \frac{\text{surface} \times \text{concentration gradient}}{\text{thickness}}$.

(Total for Question 2 = 11 marks)

ResultsPlus
Examiner Comments

This is an excellent response which was awarded both marks and shows a good understanding of Fick's Law and the ability to relate this to the context of the question.

Question 3 (a)

In order to gain full marks for this question, candidates had to relate the polarity of the water molecule to how it dissolved other molecules.

The vast majority of candidates were able to gain one mark for describing water as a polar molecule. There were even a number of diagrams drawn to show the uneven distribution of charge referenced in the response. However, only a quarter of candidates were able to gain a second mark for explaining how this polarity enabled water to be a good solvent.

3 Blood plasma contains glucose dissolved in water. Glucose is a polar molecule that is taken up by muscle cells and used in the synthesis of glycogen.

(a) Explain why water is a good solvent.

(2)

It has hydrogen bonds between the hydrogen and oxygen in each water molecule, which are weak + easily broken. Water surrounds the other molecules, dissolving them.

ResultsPlus
Examiner Comments

This gained one mark for correctly describing how water surrounds molecules allowing them to dissolve.
However, the candidate's information about hydrogen bonding was not in the context required and therefore a second mark was not awarded.

Water is a polar molecule and contains hydrogen bonding. This allows molecules are to be dissolved in it, as it can form hydrogen bonds with the oppositely charged particles from the molecule.

ResultsPlus
Examiner Comments

This is a clear and concise answer describing the polarity of the water molecule and the ability to form hydrogen bonds with other molecules. It scored full marks.

Question 3 (b)

This question was answered well by the majority of candidates who recognised that polar molecules were not able to diffuse through the phospholipid bilayer and therefore entered via facilitated diffusion through carrier proteins.

A small number of candidates referred to glucose entering the cell by endocytosis or osmosis.

It was disappointing that some candidates misread the question and incorrectly referred to water molecules entering by osmosis.

(b) Describe how glucose enters muscle cells through the cell membrane.

(2)

Glucose enters the cell through facilitated diffusion as the molecules are too large to diffuse through themselves. It is then stored as glycogen.

ResultsPlus
Examiner Comments

This response correctly describes glucose molecules entering by facilitated diffusion for one mark. However, there is no mention of either carrier or channel proteins so the second mark cannot be awarded.

Glucose is a large polar molecule, a carrier protein is needed to move it across the membrane by facilitated diffusion ~~down~~ down a concentration gradient ~~with~~ without the use of ATP

ResultsPlus
Examiner Comments

This is an example of a clear and concise answer which scored full marks.

The glucose diffuses through the ~~cell~~ muscle cells cell membrane into the muscle cells. Diffusion is net movement of molecules and/or ~~or~~ ions from a region

Glucose enters muscle cells through the cell membrane, Through osmosis which is the movement of water molecules from a region of lower concentration to a region of higher concentration through a semi-permeable membrane.

ResultsPlus
Examiner Comments

This is an example of a response which incorrectly described glucose molecules moving by osmosis and did not gain any credit.

By facilitated diffusion ~~by~~ through proteins

ResultsPlus
Examiner Comments

This response gained the first mark for correctly stating that glucose molecules enter the cell via facilitated diffusion. However, the candidate missed out on the second mark as the correct type of protein was not mentioned.

Question 3 (c)

This question required candidates to analyse the data provided to explain the effect of changing the ratio of glucose to glycogen on cell mass.

The majority of candidates were able to analyse the data to spot the effect of decreasing the ratio of glucose to glycogen on the change in cell mass. However, many then went on to describe this in more detail, which is not what the question asked.

A disappointing number of candidates did not go on to explain why there was this effect on cell mass. Fewer than 30% could relate their knowledge of the solubility of glucose (which they were told earlier in the question) or the insolubility of glycogen to this question.

A surprising number of candidates related the compact nature of glycogen to more space being available for water inside the cell.

(c) The ratio of glucose to glycogen inside a cell can affect the uptake of water by the cell. This results in a change in cell mass.

Cells with different ratios of glucose to glycogen were placed in tissue fluid and the percentage change in cell mass was recorded.

Ratio of glucose to glycogen	Percentage change in cell mass (%)
100:0	25.0
80:20	16.5
60:40	4.0
40:60	0.0
20:80	0.0

Analyse the data to explain the effect of these ratios on the percentage change in cell mass.

(3)

As the ratio of glucose to glycogen decreases so does the percentage change in cell mass, until the ratio of glucose is at or beneath 40 when there is no longer a percentage change in cell mass. As seen on the graph when there was 100% glucose as the ratio of glucose to glycogen was 100 : 0 the percentage change was 25%. however when the ratio of glucose to glycogen was 60 : 40 the percentage change in cell mass was only 4%. The ratio shows 40 and beneath there is no percentage change.

ResultsPlus
Examiner Comments

This candidate correctly interpreted the data to describe the effect of changing the ratio of glucose to glycogen on cell mass. However, they have not explained why this happens and were therefore limited to one mark.

ResultsPlus
Examiner Tip

If you are asked to 'explain' then don't just describe what the data shows as you will lose marks.

The following response gained full marks.

As the ratio of glucose to glycogen decreases, the percentage change in cell mass also decreases. This is because glucose is soluble, so will trigger an osmotic effect. In high ratios of glucose to glycogen, water enters the cell by osmosis and therefore increasing the cell mass. As the ratio gets smaller, the concentration gradient decreases, so less water enters cell and less change in cell mass. Glycogen is insoluble, so does not have osmotic effect. When the ratio is low (at 40:60 and 20:80) the water potential in and out of cell is equal, so no osmosis.

ResultsPlus
Examiner Comments

This was an excellent answer which covered all the available marking points for a maximum of three marks.

This response scored two out of three marks.

Ans Qu 11 As the ratio of glucose went up and the ratio of glycogen went down the percentage change in cell mass increased. when the ratio of glucose to glycogen was low e.g 40:60 and below, no water was uptaken by the cell, this is because glycogen is unsoluble compared to glucose. so when the ratio of glucose to glycogen increased so did the solubility of the cell so water was uptaken, as we seen when 100% of the cell was glucose the biggest percentage change of 25% occurred.

ResultsPlus
Examiner Comments

Although they have compared the solubility of glucose and glycogen this candidate has not gone on to relate this to osmotic effect. Although the candidate has understood that the change in cell mass is due to water entering the cell, 'water was uptaken' was too vague for the osmosis mark.

ResultsPlus
Examiner Tip

If you are referring to the movement of water molecules then use the term osmosis.

Question 3 (d) (i)

This question asked candidates to describe the formation of glycogen from glucose.

It was surprising how many candidates did not gain full marks in what was a relatively easy question. This was usually due to a lack of detail in their answers or misinterpretation of the question. A significant number of candidates confused glycogen with starch or described the hydrolysis of glycogen.

The most commonly awarded mark point was that glucose molecules join together in condensation reactions. Many candidates correctly stated that glycosidic bonds would be formed but did not give the detail of what type of glycosidic bonds would be formed. A significant minority thought peptide bonds would be formed.

(d) Glucose is used in the synthesis of glycogen in muscle cells.

(i) Describe the formation of glycogen from glucose.

(2)

Glycogen is a polysaccharide, when it is hydrolysed by adding a water molecule (H_2O) then it will go back to its monosaccharide which is glucose (alpha glucose).

ResultsPlus
Examiner Comments

This response illustrates a common mistake – where candidates had not read the question correctly and therefore did not gain any marks.

Glucose is a polymer chain in glycogen, making amylose and amylopecoin. Amylose is ~~as straight~~ coiled ~~Glucose~~ and only has 1'4 glycosidic bonds. Amylopecin is branched as it has 1'6 glycosidic bonds and 1'4 glycosidic bonds.

ResultsPlus
Examiner Comments

It was disappointing to see a significant number of responses where candidates confused starch and glycogen.

Glycogen is a polysaccharide of alpha glucose. It is formed when glucose molecules undergo condensation reactions and form glycosidic bonds between the molecules.

ResultsPlus
Examiner Comments

This candidate gained one mark for correctly describing glucose molecules joining together by condensation reactions. However, the extra level of detail required was not given in the description of the bonds formed.

ResultsPlus
Examiner Tip

Don't just say bonds are formed – give the detail about the types of bonds.

This response scored both marks.

many glucose monomers join together via condensation reactions to create a polysaccharide known as glycogen. The monomers are held together by several 1,4 glycosidic bonds, and has side chains of glucose with 1,6 glycosidic bonds.

ResultsPlus
Examiner Comments

This candidate clearly demonstrated that they understood how glycogen was formed from glucose.

Question 3 (d) (ii)

Question 3(d)(ii) required candidates to describe how the structure of glycogen is related to its function as a storage molecule. Approximately 40% of candidates were able to relate at least one aspect of its structure to its function as a storage molecule.

It was clear however, that many candidates struggled with the wording of the question. They often described properties of glycogen irrespective of whether they were structural or not e.g. insolubility.

Some candidates correctly referred to the branched structure of glycogen, but then failed to link this to the increased rate of hydrolysis that the branches would provide. A significant number of responses referred to the ease of hydrolysis which was not sufficient.

This response gained one mark.

(ii) Describe how the structure of glycogen is related to its function as a storage molecule.

(2)

Glycogen is very branched due to its 1,4 & 1,6 glycosidic bonds. This makes it easier for enzymes to hydrolyse. Furthermore, it is compact & can be stored in a small cell.

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Examiner Comments

This is an example of the most common reason why candidates were not awarded the first marking point.
The candidate was awarded one mark for correctly explaining why its compact structure aided its function as a storage molecule.

This response scored 0 marks.

glycogen is a large unsoluble molecule which is also enert so it can be stored and wouldnt react with anything. Therefore can be converted into glucose.

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Examiner Comments

This candidate does not answer the question asked. They needed to refer to structure of the glycogen and not its other properties.

ResultsPlus
Examiner Tip

Make you are answering the question you have been asked.

Question 4 (b)

It is important to learn to evaluate and analyse the information presented on graphs or in tables in order to answer the question which is actually asked. This is an essential skill for this specification. Here the candidates were asked to analyse the data to justify the conclusion that they were provided with. However, the majority of candidates did not refer to either active transport or the conclusion in their answer.

The majority of candidates were able to interpret the data given in the table to correctly describe the effect of temperature increasing on the number of stained cells and therefore gained the first marking point.

However, it was disappointing that the majority of candidates were not using their biological knowledge to explain why temperature caused the number of stained cells to decrease.

Where candidates did attempt to explain the trend they had identified, credit was given for either the idea that less stain was taken up by the cells, or that the membrane increased in permeability and therefore the stain was able to leave the cell.

This response scored one mark.

(b) Analyse the data to justify the conclusion of this investigation.

(3)

As the temperature increased the percentage of stained cells ~~decreased~~ stayed the same until it ~~rose~~ reache 40°c in which it started to decreak. The colour of solution surrounding the red blood cells remained colourless until 50°c with a percentage of stained cells at 81%. In which it turned a pale blue and then blue at 60°c with 17% of stained cells.

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Examiner Comments

This was typical of the majority of responses. The effect of temperature on the number of stained cells was correctly described, but no biological knowledge was used to explain this effect.

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Examiner Tip

If the question refers to a conclusion then make sure you do too.

This response gained full marks.

We can see that as the temperature increased the percentage of stained cells saw a decrease. This conclusion was only made clear to us after the temperature exceeded 30°c. The % of stained cells red blood cells saw this decrease because the temperature denatured the phospholipids and the proteins in the cell membrane. The heat caused the phospholipids to move around more, creating gaps which don't allow all of the BCB to be taken up. The carrier protein involved has stopped functioning as efficiently as the heat is causing its bonds to break. Its losing its structure and shape. As a result it can't take up the BCB. More of the solution is left, causing it to be pale blue and blue in 90° and 60°.

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Examiner Comments

Here the candidate is correctly relating increasing temperature to the effect on the cell surface membrane. They have also understood that carrier proteins must have been involved in active transport and that they have denatured, causing less stain to be taken up by the cells.

ResultsPlus
Examiner Tip

Ensure that you make use of all of the information you have been provided with.

Question 4 (c)

This question asked candidates to consider ways in which the investigation of the effect of temperature could be improved.

It was pleasing to see that the vast majority of candidates could relate their experience of core practical 3 to this context. The most common improvements centred on repeats and the use of a colorimeter.

A minority of candidates were confused over the difference between qualitative and quantitative data and therefore did not gain the linked justification mark for the colorimeter improvement.

It is worth noting here that extending the range of temperatures was not accepted – the idea of smaller temperature intervals to determine the temperature at which active transport was affected was needed instead.

(c) Explain **one** way in which this investigation could be improved.

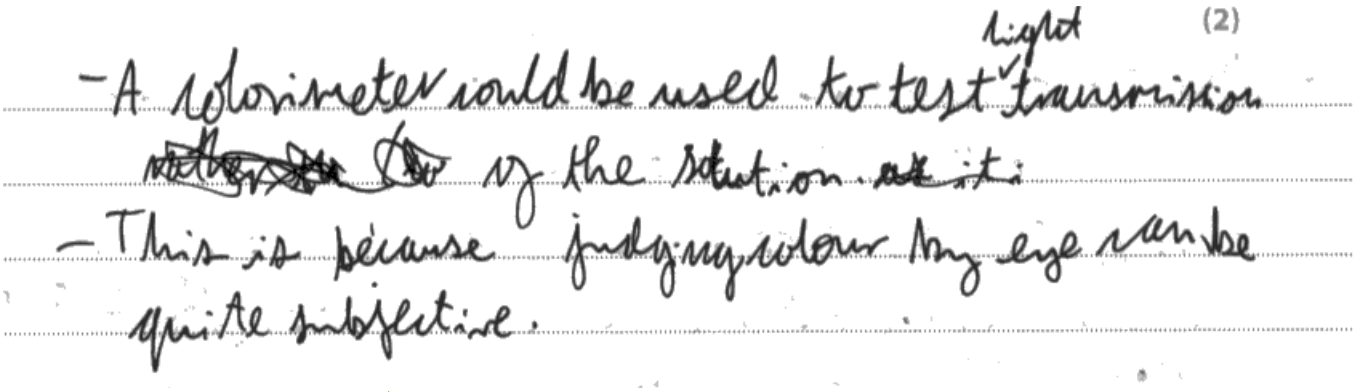
(2)

The more temperatures could have been used at smaller intervals because so that it is clear when the uptake of BCB begins to decrease. Also this would show if the colour of the solution changes steadily compared to rapidly.

ResultsPlus
Examiner Comments

This gained two marks for the suggested improvement of smaller temperature intervals with a correct linked justification.

This response scored two marks.



ResultsPlus
Examiner Comments

This response gained full marks for explaining why the use of a colorimeter would improve this investigation.

ResultsPlus
Examiner Tip

Make sure you spell scientific terms correctly. A cAlorimeter is a totally different piece of equipment that would not be accepted here.

Question 5 (b) (i)

This question asked the candidates to plot the diet of a mink on the diagram provided. The diagram already had 5 animal diets with an accompanying key. The stem of the question gave information about the dog diet and candidates were expected to use this information to understand how to plot the mink diet accurately.

It was pleasing to see that the vast majority of candidates were able to do this, although some did not use the triangle symbol for mink from the key.

Question 5 (c) (i)

This question provided candidates with a table of data of daily energy requirements. Candidates were required to extract the correct information from the table and then use it to calculate a percentage increase in the average daily energy requirements for boys aged 17 compared with their requirements at age 13.

Most candidates were able to extract the correct numbers (10090 and 12886) and knew that they had to calculate the increase. Therefore, if they showed their working, they were able to score one mark even if their answer was incorrect.

It was surprising how many candidates divided the increase of 2796 by 12886 instead of 10090, resulting in the incorrect answer of 21.7%. As this qualification now has to include a certain number of maths marks aimed at Level 2 or above, it is important that candidates are secure with the maths skills identified in the specification.

This response gained one mark out of two.

(i) Calculate the percentage increase in the average daily energy requirements for boys aged 17 compared with their energy requirements aged 13.

(2)

12886KJ = 17 boys 10090KJ = 13

$\frac{(12886 - 10090)}{12886} \times 100 = 21.697$

$= 21.7\%$

Answer 21.7 %

ResultsPlus
Examiner Comments

This response shows the most common mistake made by candidates. They divided by the wrong number. However, they gained one mark for 12886-10090.

ResultsPlus
Examiner Tip

Always show your working! Without the working this response would have gained 0 marks.

This response scored full marks.

(i) Calculate the percentage increase in the average daily energy requirements for boys aged 17 compared with their energy requirements aged 13.

(2)

$12886 - 10090 = 2796$

$\frac{2796}{10090} = 0.2771060456 \times 100 = 27.7106...\%$

$\frac{12886 - 10090}{10090} \times 100 = 27.7106..$

$= 27.71\% \text{ (2dp)}$

Answer 27.71 %

ResultsPlus
Examiner Comments

This response scored full marks for a correct calculation.

ResultsPlus
Examiner Tip

Ten percent of the paper will involve maths at Level 2 or above. The specification shows what maths skills are required.

Question 5 (c) (iii)

This question required candidates to state what would happen to the additional energy if someone took in more energy than required.

The majority of candidates wrote that the energy would be stored as fat and therefore were awarded the mark. Some candidates gave the alternative answer that the energy would be stored as glycogen.

A significant minority of candidates were not as specific in their answers. Answers referring to people gaining weight were insufficient as they were not explaining what was happening to the energy.

This response scored one mark.

(iii) State what will happen to the additional energy if an individual takes in more energy than is required.

(1)

It will be stored as fat.

ResultsPlus
Examiner Comments

This was the most common type of correct response.

This response gained 0 marks.

they will gain weight.

ResultsPlus
Examiner Comments

This is an example of the most common type of response which gained 0 marks.

Question 5 (d)

This was a very discriminating question where the full range of marks was awarded.

The stem of the question gave three statements about people with cystic fibrosis.

Statement 1 expected candidates to explain why people with cystic fibrosis required a higher energy diet than people without cystic fibrosis.

Statement 2 required candidates to explain why people with cystic fibrosis were more likely to develop problems in their pancreas.

Statement 3 required candidates to explain why males with cystic fibrosis are less likely to be able to release sperm.

There was a lot of indicative content in the mark scheme and candidates were not expected to include all the material which was indicated as relevant. However, linkage needed to be made to relevant scientific ideas and candidates needed to apply relevant biological facts / concepts in order to move above Level 1.

Candidates needed to have discussed at least two out of the three statements and made a link to the thick, sticky mucus in people with cystic fibrosis to achieve Level 2.

To move into Level 3, candidates needed to have discussed all three statements with relevant biological knowledge, made a link to the thick, sticky mucus in people with cystic fibrosis and explained their points using their knowledge of the non-functioning CFTR protein channel and gene mutations.

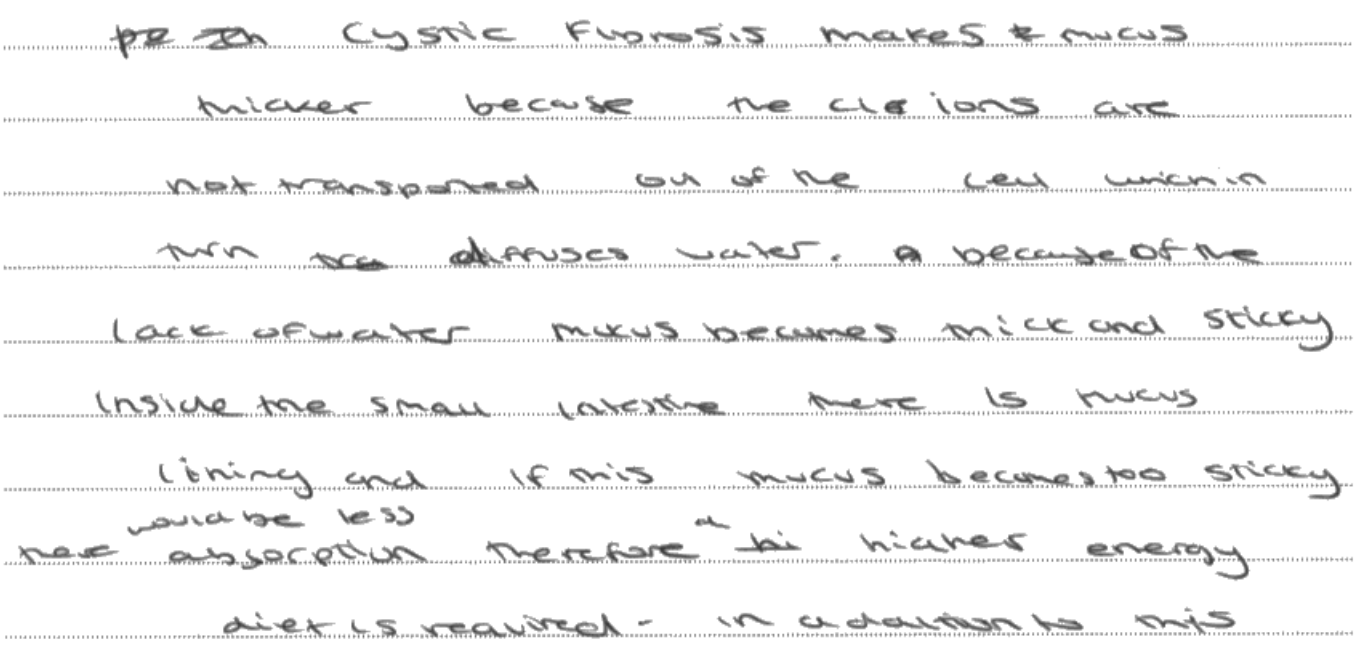
This Level 2 response was awarded 4 marks.

*(d) People with cystic fibrosis require a higher energy diet than people without cystic fibrosis. They are also more likely to develop problems in the pancreas.

Men with cystic fibrosis are less likely to be able to release sperm.

Discuss why a person with cystic fibrosis could have these symptoms.

(6)



the the pancreatic duct a can also become blocked by the mucus meaning the pancreas can't release enzymes to break down the food again less absorption finally the sperm duct also has mucus and men with cystic fibrosis [redacted] have their sperm duct blocked meaning the sperm cannot come out of the penis.

ResultsPlus
Examiner Comments

This response linked thicker mucus to the idea that:
– the enzymes can't enter the intestine due to the pancreatic duct being blocked with mucus
– the sperm can't exit the male's body as the sperm duct was blocked with mucus.
Therefore they have correctly discussed two out of the three statements and made links to relevant biological concepts, including thicker mucus and chloride ions.
There is an appropriate structure.
The higher mark was awarded.

This response scored 2 marks.

People with CF will require a higher energy diet than people without as their pancreatic duct will be blocked by the mucus. Not all of the enzymes will be able to successfully leave the duct, so as a result food will go undigested. If its undigested the person won't be able to obtain nutrients and energy from it hence the reason why they eat high energy diet.
The problems with the pancreas will arise from the enzymes that are unable to leave the pancreatic duct. They could begin to digest the lining of the [illegible] duct itself as they are not

unable to leave the duct. Cysts could also form leading to problems in the pancreas.

The mucus from CF will also block the sperm duct (vas deferens). This means that when a man ejaculates, not all sperm will be released as some will be blocked and trapped by the mucus of CF.

ResultsPlus
Examiner Comments

This response discusses all three statements well. However, there is no linkage to the relevant scientific idea and concept about these symptoms being caused by the production of thick / sticky mucus and therefore it is limited to Level 1.

ResultsPlus
Examiner Tip

Think about the biology that relates to your statements.

Question 6 (a)

This question asked candidates to explain how the structure of an artery wall is adapted both to withstand and to maintain high blood pressure. This question differentiated well between the candidates and the full range of marks was awarded.

A number of very good responses were seen which addressed all areas of the question asked.

However, a significant number of candidates did not answer the question asked and explained about the generalised structure of an artery and not just the wall. In addition, few candidates were able to successfully explain how it was adapted to withstand high blood pressure.

The most commonly awarded mark was for the elastic fibres allowing recoil. Few candidates successfully explained why collagen helped the artery to withstand pressure.

6 Atherosclerosis is more likely to occur in arteries due to the higher blood pressure in these blood vessels.

(a) Explain how the structure of an artery wall is adapted both to withstand and to maintain high blood pressure.

(3)

Arteries have 3 layers; tunica externa (outer layer), tunica media and tunica intima. The tunica externa is made of collagen which is for strength and support, it can withstand the high blood pressure. The tunica media has smooth muscles to contract and constrict blood flow and has elastic fibres to stretch and recoil to maintain the high blood pressure. The tunica intima is endothelium and is smooth to minimise the amount of friction between the blood and the wall of the artery.

ResultsPlus
Examiner Comments

This was a very well-written answer which answered all aspects of the question to score full marks. The structure of the artery wall was linked well to its role to either withstand or maintain high blood pressure.

→ The Arery wall has a Narrow lumen.
→ more to elastic fibres
→ more collagen
→ The elastic fibres allow, the arery to stretch and recoil, the Narrow lumen allow the ~~arery~~ arery to withstand the high blood ~~pr~~ pressure. The structure allows it to recoil and allows it well adapted for maintaing high blood pressure.

ResultsPlus
Examiner Comments

This is an example of an answer which gained the most commonly awarded mark – for elastic fibres allowing recoil. Although this candidate knew that the artery wall contained collagen, they did not explain how this helped to withstand pressure.

ResultsPlus
Examiner Tip

Make sure you answer all parts of the question that you are asked.

Question 6 (b) (i)

This was a very well-answered question, with many candidates scoring full marks by giving clear descriptions of how high blood pressure could result in atherosclerosis. This was a topic that was also examined on the 2016 paper and it was clear that candidates were gaining higher marks in this examination series than in the previous one.

A minority of candidates did not gain the first marking point because they referred to capillaries or blood vessels in general, instead of arteries. A small number of candidates confused epithelium with endothelium, which negated the mark. The next three marking points were nearly almost always awarded; however, a few candidates mixed up the order of the atheroma and plaque forming which negated one of the marks.

This response gained full marks.

(b) A person with very high blood pressure has an increased risk of developing atherosclerosis.

(i) Describe how very high blood pressure could result in atherosclerosis.

(3)

The high blood pressure can cause damage to the endothelium resulting in an inflamatory response. white blood cells will stick to the damaged wall and LDL will deposit forming atheroma. Then salts, proteins and fibrous tissue will build up on the atheroma causing plaque to form and build into the lumen. this has positive feedback and blood pressure will increase further. If the plaque breaks off and blocks the coronary artery it can result in a myocardial infarction (heart attack).

ResultsPlus
Examiner Comments

This response did not gain the first marking point as there was no reference to artery. However, it gained the next three marking points to score the maximum number of marks available.

This response did not gain any marks.

(i) Describe how very high blood pressure could result in atherosclerosis.

(3)

atherosclerosis is the blocking of the artery due to fatty deposit in the arteries. High blood pressure (very) could lead to ~~atte~~ atherosclerosis because the person has not ~~been~~ been living healthy such as too much ~~cho~~ cholerestrol in the body, inactivity, the person could be obesed and so on. The blood pressure is measured with a Sphygmomanometer.

ResultsPlus
Examiner Comments

Although this candidate has attempted to explain what atherosclerosis is, they haven't used the terminology that was required. They did not go on to explain how blood pressure could result in atherosclerosis and therefore no marks could be awarded.

ResultsPlus
Examiner Tip

Make sure you use the correct terminology in your descriptions.

High blood pressure can lead to damage of the endothelium in the artery. This triggers an inflammatory response which causes a fat and white blood cells to build up on the wall of the artery causing an atheroma. This may go hard and form a plaque which results in atherosclerosis.

ResultsPlus
Examiner Comments

This is a clear and succinct answer which matched every marking point for a maximum 3 marks.

ResultsPlus
Examiner Tip

Don't feel you have to fill all the answer space! Plenty of space is often given as some candidates have large writing or write longwinded answers and run out of room.

Question 6 (b) (ii)

This question was a good differentiator. It required candidates to explain how atherosclerosis in one part of the artery could increase the likelihood of it developing in another part of the same artery.

The majority of candidates scored at least 1 mark out of 2 for stating that the blood pressure would increase. Around a fifth of candidates did not gain this mark and this was often due to references to high blood pressure which were not sufficient as the blood pressure would already be high in an artery.

Approximately 40% gained both marks for correctly explaining why the blood pressure would have increased: that the lumen / artery would be narrowed.

This response gained one mark.

(ii) Explain how atherosclerosis in one part of an artery could increase the likelihood of it developing in another part of the same artery.

(2)

If One ~~Part~~ Part of artery have ~~ca~~ atherosclerosis the blood pressure will be even higher the higher pressure could damage the other part of the endothelium which lead to more ~~other~~ atherosclerosis.

ResultsPlus
Examiner Comments

This is an example of the most common type of response. The candidate has correctly stated that the blood pressure would be higher due to atherosclerosis, but has not gone on to explain why.

ResultsPlus
Examiner Tip

If you are writing that something would happen it's usually a good idea to explain why it would happen.

Because the atheroma and plaque narrows the lumen so blood pressure increases further which can cause damage to the endothelium again in another area.

ResultsPlus
Examiner Comments

This well-written answer linked the narrowing of the lumen to the increase in blood pressure and therefore gained full marks.

Question 7 (a)

This question asked candidates to describe how nucleotides joined together to form DNA and it was surprising how well this differentiated when it was expected to be a high scoring question.

Approximately a fifth of candidates did not gain a mark. The most common reason was that an incorrect bond was given. Where phosphodiester bonds were stated, the mark sometimes could not be awarded as it was in the wrong context. For example, some responses referred to bonds forming between a phosphate and a ribose sugar. A significant number of responses referred to hydrolysis instead of condensation reactions.

Approximately half of all candidates gained one mark. This was normally for the bond marking point. A significant number of candidates gave both phosphodiester bonds forming between nucleotides and hydrogen bonds forming between bases but were limited to one mark. Very few candidates referred to DNA polymerase.

This response gained full marks.

7 DNA is a polymer made from monomers called nucleotides.

(a) Describe how nucleotides join together to form DNA.

(2)

~~DNA nucleotides join together by~~ with ~~bonds~~

DNA polymerase joins the DNA nucleotides together.

~~and hydrogen bond and~~ by condensation reaction

and forms phosphodiester bond between them.

ResultsPlus

Examiner Comments

This is an example of a response which correctly matched all three marking points for a maximum of 2 marks. It refers to DNA polymerase which was the least commonly awarded marking point.

nucleotides join by phosphodiester bonds between the pentose sugar deoxyribose of one nucleotide and the phosphate group of another nucleotide.

ResultsPlus

Examiner Comments

This response gained one mark for stating (in the correct context) that phosphodiester bonds would join the nucleotides together.

This response scored one mark.

They have phosphodiester bonds between adjacent nucleotides (vertically). Hydrogen bonds for between the bases of two complementary nucleotides.

ResultsPlus
Examiner Comments

This is an example of a response where both alternatives of the second marking point were awarded.

This response scored 0 marks.

Nucleotides join using peptide bonds between each other to form strands which is turn form DNA.

ResultsPlus
Examiner Comments

This candidate referred to peptide bonds being formed which is incorrect and therefore no marks could be awarded.

Question 7 (b)

This question was a very good differentiator and the full range of marks was awarded.

Candidates were required to analyse the data, provided in both Figures 1 and 2, to explain why one model was accepted / rejected by Meselson and Stahl. A significant number of candidates did not refer to the data however, which limited the number of marks that could be awarded.

Where reference was made to the information provided, many candidates described instead of explained and therefore the final two marking points were rarely awarded.

This response gained four marks.

Analyse the data to explain why Meselson and Stahl accepted one of the models for DNA replication and rejected the other.

(4)

Semi conservative replication is where after replication one strand is new whereas the other is old. They rejected the conservative model as when the DNA was centrifuged after 1 generation the DNA was intermediate which meant it contained both heavy (^{15}N) and light (^{14}N) DNA as one strand was old and one strand was new. After the second generation there was 50% intermediate and 50% light. 3rd generation contained 75% light and 25% intermediate. If it was conservative there would only be heavy and light DNA not intermediate

ResultsPlus
Examiner Comments

This response used the data to explain in a clear and succinct way why the semi-conservative model was accepted and the conservative model was rejected.

ResultsPlus
Examiner Tip

Make sure your answer uses all the data you have been provided with.

Question 7 (c)

This question required candidates to apply their knowledge of DNA nucleotide structure. They were asked to compare and contrast this with the given ATP structure.

Candidates struggled with the requirements of this type of question. They often did not refer to both ATP and DNA structures or use comparative language in their answers and this reduced the number of marks that they could be awarded.

A significant minority of candidates did not compare ATP with DNA. Answers included comparisons of DNA with RNA, or ATP with RNA.

This response gained three marks.

Compare and contrast the structure of ATP and a DNA nucleotide.

(3)

A DNA nucleotide ~~only has~~ contains a phosphate molecule, whereas ATP contains triphosphate (3 phosphate molecules bonded together). A ~~xxxx~~ DNA nucleotide contains deoxyribose, whereas ATP contains ribose. A DNA nucleotide can contain adenine, thymine, guanine or cytosine, whereas ATP can only contain adenine.

ResultsPlus
Examiner Comments

This candidate has compared the structure of ATP and a DNA nucleotide in a very clear and easy to mark way. They have gained the maximum of 2 marks for differences and they have gained the similarity mark for the content of the response as a whole.

ResultsPlus
Examiner Tip

Comparing and contrasting means you must refer to both similarities and differences in your answer.

This response scored one mark.

An ATP molecule and a DNA nucleotide both contain a ribose sugar as the central molecule.

However, ATP contains 3 phosphate groups whereas nucleotides only contain 1.

Furthermore, they both contain bases but ATP contains an adenine base.

ResultsPlus
Examiner Comments

This is an example of a response where the candidate has confused DNA and RNA structures and referred to ribose sugar. This meant that the similarity mark and one difference mark could not be awarded. They have also not fully compared the base types.
They have correctly compared the number of phosphates to score one mark.

ResultsPlus
Examiner Tip

Make sure you know the differences between the structures of DNA and RNA.

Question 8 (a)

This question was designed to be a straightforward question, but it was surprising how many candidates ignored the word 'biological' in the question and therefore did not gain any marks for their answers.

The majority of candidates could explain what a catalyst is, with most explaining how the activation energy would be reduced, but this could not gain the mark.

Candidates needed to refer to biological reactions, or give an indication that the reactions occurred in cells or living organisms as well, in order to gain the mark.

This response scored 0 marks.

(a) State why enzymes are described as biological catalysts.

(1)

They speed up reactions by d lowering activation energy

ResultsPlus
Examiner Comments

This is an example of the most common response – reference to reducing activation energy. There is no biological reference so the mark could not be awarded.

This response scored 0 marks.

They speed up the rate of reaction.

ResultsPlus
Examiner Comments

This is an example of where the candidate has not fully answered the question asked. They have explained what a catalyst is and not a biological catalyst.

Enzymes speed up a biological reaction by lowering the activation energy

ResultsPlus
Examiner Comments

This response gained one mark for a correct statement about enzymes speeding up biological reactions. They also gave the extra detail about reducing activation energy.

This response scored one mark.

Enzymes speed up reactions just like catalysts do. However, enzymes are found naturally in organisms.

ResultsPlus
Examiner Comments

This is a good response showing the candidate's understanding of enzymes as biological catalysts.

ResultsPlus
Examiner Tip

Make sure you are answering the question asked.

Question 8 (b) (i)

This question asked candidates to compare and contrast the molecular structures of collagen and an enzyme. As with Question 7(c), candidates seemed to struggle with this type of question.

The most commonly awarded mark was for correctly stating that the enzyme/arazyme was a globular protein whereas collagen was a fibrous protein.

Common mistakes included:

- Comparative language was rarely used. Candidates often just described one protein and then the other and often the descriptions didn't cover the same aspects of structure. However, a few candidates decided to use a table to ensure that they made points for each protein type for each aspect of structure.
- Confusing collagen with cellulose.
- Few candidates gave a similarity between the two types of proteins. The mark that was expected to be the most accessible (chains of amino acids joined by peptide bonds) was rarely awarded which was surprising.

This response scored full marks.

(b) One of the enzymes injected into the prey is called arazyme. Arazyme is a protease enzyme that can break down collagen.

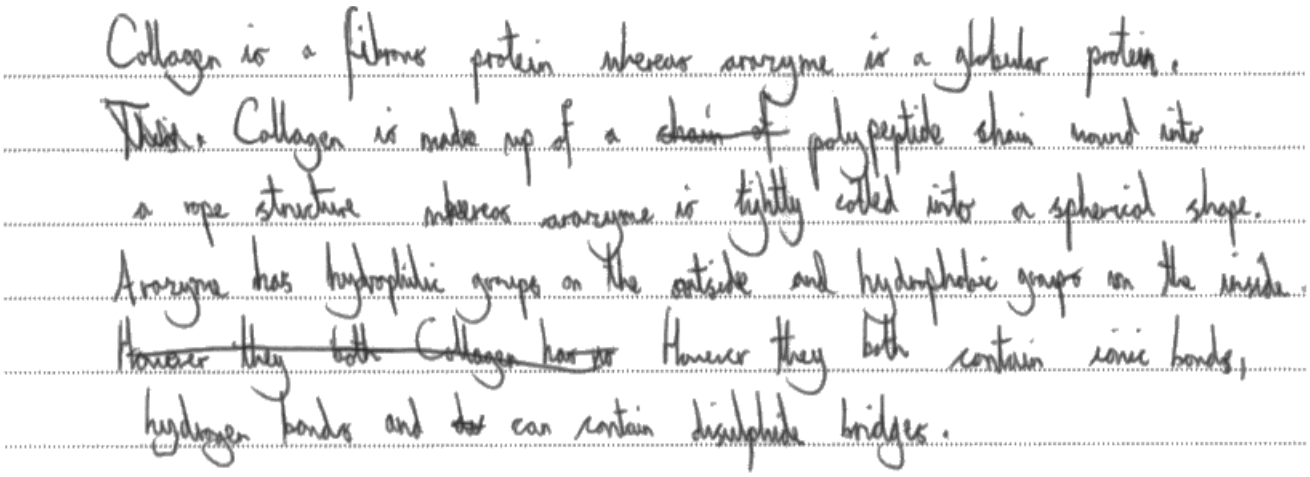
(i) Compare and contrast the molecular structure of collagen and an enzyme such as arazyme. (4)

Collagen is a fibrous protein, whilst the enzymes such as arazyme is a globular protein. As a result, arazyme has a tertiary structure, whilst collagen does not. Furthermore, Arazyme has hydrophilic side chains that project from the outside, whilst Collagen has hydrophobic side chains that project from the outside. Both collagen and arazyme are made up of hydrogen amino acids joined up by peptide bonds. Arazyme also contains an active site, whilst collagen does not.

ResultsPlus
Examiner Comments

This is a well-written response which identifies a similarity between the two types of proteins and uses comparative language when explaining the differences.

This response scored two marks.



ResultsPlus
Examiner Comments

This response gained the most commonly awarded marking point for correctly stating whether the proteins were globular or fibrous. They also gained the named bonds similarity mark. However, they made the mistake of only referring to the R groups on the surface of arazyme and not collagen; therefore they did not gain this difference mark.

ResultsPlus
Examiner Tip

In a compare and contrast question about molecules it is a good idea to refer to both molecules for every point you make.

Question 8 (b) (ii)

This question was a very good differentiator, with an almost even spread for 0-3 marks and about a tenth of candidates achieving 4 marks. There were some very good descriptions of procedures that could be used for the given context.

Candidates were expected to apply their knowledge from the core practical to the new context given in the stem of the question.

Candidates were able to give variables that should be controlled in the experiment and this was the most commonly awarded mark. However, a minority of candidates did not understand or read the information given in the stem of the question; that changes in pH during collagen hydrolysis would cause the colour change and referred to using buffers to control the pH. It was pleasing to see that very few candidates used 'amount' in their answers and used terminology such as 'volume' instead.

Lack of precision in answers often prevented the awarding of the independent variable mark as candidates would refer to preparing a range of concentrations, without stating how many would be used. A minority changed the volume of enzyme instead of the concentration. It was pleasing to see that some candidates were able to give 5 or more concentrations of enzyme that would be suitable.

Few candidates were able to transfer the idea of using a colorimeter or comparing to a colour standard from core practical three to ensure that the same end point was reached. This was the least commonly awarded marking point.

A significant minority of candidates used methods that were not suitable, for example titrations. As per a similar type of question on the 2016 paper, many candidates referred to carrying out repeats without stating that this needs to be for all values in the IV range.

This response scored three marks.

(ii) The hydrolysis of collagen results in a decrease in pH. The indicator phenolphthalein is pink at pH 8 and becomes colourless at lower pH values.

Devise an investigation to determine the effect of arazyme concentration on the rate of hydrolysis of collagen.

(4)

You will need 5 different known concentrations of arazyme. Have a sample of zero percentag concentration of arazyme as a control. The enzyme arazyme should be extracted from the same spider. Get a sample of collagen from the same source. Use the same volume of enzyme concentration and record the rate of hydrolysis. Repeat

the experiment for reliability.
Add the same volume of phenophthalein in each sample and record how long it takes until the solution turns colourless.

ResultsPlus
Examiner Comments

The candidate referred to 5 concentrations of arazyme, stated at least one variable that should be controlled and that the time taken for the phenolphthalein to decolourise should be measured.

This response scored two marks.

Make up different concentrations of arazyme and a control group. Then add ~~phenolphthale~~ phenolphthalein indicator to each test tube to indicate the pH. Add in a known volume of collagen into each test tube and let the reaction take place until there's no further colour change. Use a pipette to get the solutions into cuvettes and place them in a colorimeter to get a reading of the absorbance. As the concentration of enzyme increases, the colour of the indicator should be less visible

ResultsPlus
Examiner Comments

This candidate did not score the IV mark as they have not stated that five different concentrations would be used.

(4)

You should have 5 different concentration of trypsine and the 5 same concentration of collagen. You put the first concentration of trypsine into the first collagen solution and measure the amount of oxygen produced in 10 minute. You record the results. ~~To make the investigation val~~ You do the same with the rest of the concentration of trypsine. To make the result valid carry the experiment 3 times and find the average of each result. You need a controled experiment for valid results.

ResultsPlus
Examiner Comments

This candidate has not used the information given in the stem of the question about the change in colour of phenolphthalein and can therefore not get either mark relating to the DV.

ResultsPlus
Examiner Tip

Read the question carefully and make sure you answer the question that you were asked.

Question 8 (c)

This question gave candidates various data to read and analyse. They were expected to apply their knowledge of enzyme activity and denaturation to this context to decide if the conclusion stated was valid. The majority of candidates struggled to understand why the conclusion was not valid.

Common mistakes included:

- commenting that the experimental procedure was not valid
- not understanding that the product lowered the pH of the solution and would therefore denature the enzyme, resulting in a reduced rate of reaction
- referring to substrate concentration limiting the rate of reaction
- commenting that the conclusion was 'not very valid' which was not sufficient for the mark.

The most commonly awarded mark was for describing that the rate of reaction for A did not decrease immediately.

This response scored two marks.

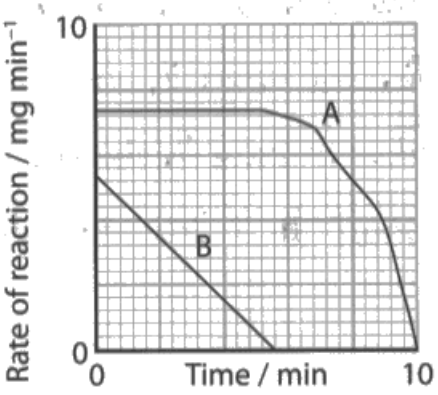
(c) The effect of substrate concentration on the rate of an enzyme reaction was investigated.

Two substrate solutions, A and B, were used. Solution A had a higher concentration than solution B. The optimum pH for the enzyme was pH 7.

The product lowered the pH of the solution.

The rate of reaction was determined at 1-minute intervals for 10 minutes.

The graph shows the results of this investigation.



It was concluded that the product reduces the activity of the enzyme.

Comment on the validity of this conclusion.

(4)

It is not valid because it does not test if the product reduces the enzyme activity. Only 2 concentration was used so it may not be accurate. The rate of reaction may not have been affected by the product. Solution A would have produced more product but its rate of reaction did

not fall until 5 minutes. Solution B's rate of reaction started falling from the start meaning the reason could be because of its low concentration of substrate.

ResultsPlus
Examiner Comments

This candidate has correctly stated that the conclusion is not valid and has also given the most commonly awarded point about A's rate of reaction not decreasing immediately.

ResultsPlus
Examiner Tip

Make sure you use all the information given. This response has not used the information about products lowering pH.

This response scored 0 marks.

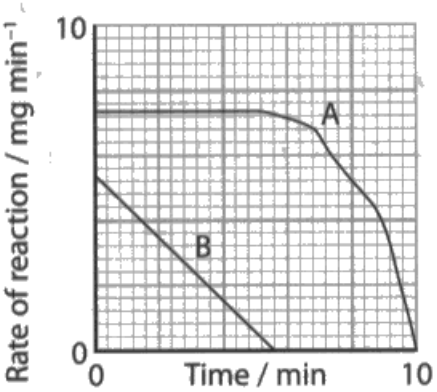
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It was concluded that the product reduces the activity of the enzyme.

Comment on the validity of this conclusion.

(4)

The experiment is not valid because only two substrate solutions were used instead of atleast 5. The substrate solutions were not identified whether they are of the same source. The time allowed is to short to notice an overall effect. The two

Substrate solution are not displaying any ~~relationship~~ relationship. The experiment was not repeated.

ResultsPlus
Examiner Comments

This is an example where the procedure was analysed and not the validity of the conclusion.

Paper Summary

To help prepare for this paper in future, please take note of the following points.

- Read the whole question carefully, including the introduction, to help relate your answer to the context asked. You should take into account the command words as well as the context given. Do not try and make a mark scheme you have learnt from a previous paper fit a different question with different command words and a different context.
- Read your answers back carefully – do they answer the question, have you made at least as many clear points as marks are available, and have you used all the information you have been provided with?
- When asked to compare and contrast make sure your answer is comparative and you mention both similarities and differences.
- Include your working with all calculations.
- When describing the measurement or control of variables, be specific about what is to be measured e.g. volume or mass, and how it is to be measured. Avoid vague terms such as amount.

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