

Examiners' Report

June 2024

IAL Biology WBI11 01

Introduction

The quality of responses was noticeably higher this series, both in biological content and in clarity of expression. Centres are clearly familiar with the requirements of this specification now and are using past papers, mark schemes and examiner comments to prepare their candidates for the exam. This includes an appreciation of what is meant by the various command words that are used. Candidates also seemed to be more confident in their mathematical skills as the maths questions scored better than previously.

Examiners saw a good range of responses that included all mark points. There appeared to be fewer questions left completely blank, including the two levels-based questions.

Question 1 (c)

This question is a fairly straightforward start for most candidates with the majority picking up the first and second mark point, with the more able candidates generally naming a bond between R groups. Surprisingly, very few candidates mentioned the active site despite the topic of the question being clearly enzymes. Many candidates started their response by writing about the primary response; although this did not count against them, it would have used up exam time.

(c) Describe how a chain of amino acids can form an enzyme molecule.

(3)

When a chain of amino acids form peptide bonds between each other they form the primary structure of which is a straight line of amino acids then they form hydrogen bonds between each other forming an α helix or β sheet then with a 3 dimensional tertiary structure with the help of disulphide and ionic bonds form using the R group in a circular structure called a globular protein which all enzymes are.



ResultsPlus
Examiner Comments

This response illustrates the points discussed in the introduction, with this candidate starting their story with the primary structure of a protein and then picking up the marks for describing the secondary and tertiary structure and naming some bonds.



ResultsPlus
Examiner Tip

When naming bonds involved in the secondary and tertiary structure of a protein, it is important to state that the bonds are formed between the R groups.

(c) Describe how a chain of amino acids can form an enzyme molecule.

(3)

Amino acids are bonded together with peptide bonds in a condensation reaction. The type and positions of amino acids determine the type and position of R-group, bonds (e.g. hydrogen, disulphide and ionic) that form. This determines the folding of the protein in its 3D structure. This determines the shape of the active site of the enzyme and, hence, its function.



ResultsPlus
Examiner Comments

Another good response that has picked up second, third and fourth mark points.

Question 2 (b)

Candidates have been asked to name mutations in previous series and, as in previous series, candidates are expected to use the names of the mutations given in the specification. Other descriptions, such as frameshift or subtraction for example, are ignored and not credited.

Question 2 (c)

The majority of candidates could conclude that the mutation rate decreased as the age of breeding increased and that prosimians had the highest mutation rate. Many commented on the large range bars for the prosimians but failed to make an actual conclusion that can be drawn from them. The other conclusions on the mark scheme were made but infrequently.

Describe **two** conclusions that can be made about the mutation rate in these four groups of primates.

(2)

1 prosimians has the highest mutation rate and has the higher range of mutations

2 apes have the lowest mutation rate and apes start to breed at different ages



ResultsPlus
Examiner Comments

This candidate's response scores the two prosimian marks (1 and 5 additional guidance).



ResultsPlus
Examiner Tip

If there is a mark for commenting on the highest, in this case highest mutation rate, then it is worth commenting on the lowest as well in case both aspects are needed for one mark. However it is unlikely that naming the highest and lowest will score two marks, so try and pick out another conclusion to write about.

The question asks for conclusions about mutation rates, so commenting on anything else will not score marks; in this response the comments about apes breeding at different ages is irrelevant to the question.

Question 3 (a)

Many candidates could tell that RNA polymerase was involved in transcription, although there was the expected confusion between transcription and translation. Most candidates have good knowledge of the transcription process but some responses simply described the process and did not make it clear what the exact role of the enzyme is.

There were not many responses that mentioned the role of the enzyme in repair but this was not unexpected; it is however included in the mark scheme as a valid point.

3 The process of protein synthesis involves RNA polymerase, start and stop codons and ribosomes.

(a) Describe the role of RNA polymerase in protein synthesis.

(2)

RNA polymerase is an enzyme that catalyses the formation of the mRNA strand by joining mRNA nucleotides to the template strand of the DNA, forming phosphodiester bonds between the mRNA nucleotides.



ResultsPlus
Examiner Comments

This is an example of a response that makes it very clear what RNA polymerase is doing in transcription.



ResultsPlus
Examiner Tip

In questions like this, do not write everything you know about a topic – read the question carefully and apply your knowledge to what is being asked.

3 The process of protein synthesis involves RNA polymerase, start and stop codons and ribosomes.

(a) Describe the role of RNA polymerase in protein synthesis.

(2)
It attaches to the ~~mRNA~~ Promoter of the gene on the DNA template strand in the nucleus and aligns complementary free RNA nucleotides to it forming the phosphodiester bonds between them to synthesise mRNA.



ResultsPlus
Examiner Comments

This response illustrates some other points that could be made in order to be awarded the marks.

Question 3 (b)

The command word 'compare and contrast' is now becoming very familiar to centres and as a consequence, many candidates have a clearer understanding of how to answer this type of question. Examiners are seeing fewer descriptions and more actual statements about similarities and differences. Although comparing the start and stop codons is quite hard, there were some good attempts at making statements about their similarities and differences.

Unsurprisingly, the mark points most frequently awarded were the first and second ones, provided responses specifically mentioned translation and not a vague reference to protein synthesis. The other three mark points were seen but the most common misconception was that there was a tRNA, that did not carry an amino acid, for the stop codon.

(b) Compare and contrast the structure of the start and stop codons and how they work.

(3)

Ans: Both start and stop codons are made of triplets of bases. However, start codons code for amino acids but stop codons do not code for amino acids. Start codons start the translation process but stop codons stop the translation process. Start ^{codon} is always the same, AUG but stop codon can be three types, UGA, UAA, UAG.



This is an example of a well-laid out, clear response that demonstrates many of the mark points.



Write your response in two halves. The first half lists all the similarities that you can think of. The second half lists the differences you can think of. Make sure you have written at least one of each as you will not get full marks if you do not cover both aspects.

Question 3 (c)

Many candidates demonstrated in their responses that they have good knowledge of the translation process but, like in responses to Q03(a), the knowledge was not applied to the question. Papers have asked about the role of ribosomes in previous series but candidates are still not grasping the fact that the ribosomes' role is to actually hold the two tRNAs together and onto the mRNA.

(c) Describe the roles of the ribosomes in protein synthesis.

(2)

- ribosomes hold mRNA & tRNA together so tRNA can translate the mRNA Codon by a specific anticodon found in the on a specific region of specific tRNA molecules. Ribosomes then catalyse the formation of peptide bonds between the amino acids coded for by the codons found on mRNA that were transcribed ~~to~~ from DNA Antisense strand



ResultsPlus
Examiner Comments

This response covers all three of the mark points; it makes it very clear exactly what the ribosomes are doing during translation.

Question 4 (b)(i)

On the whole, candidates could list two factors that affect the rate of diffusion. The commonest error was to write surface area to volume ratio, an expression that they have learnt without really appreciating its significance or its application.

(b) Capillaries enable the movement of molecules between the blood and cells.

The distance the molecules diffuse between the blood and cells affects the rate of diffusion. This is the diffusion distance.

(i) Name **two** other factors that affect the rate of diffusion.

- 1 Surface area
- 2 Concentration gradient



These are probably the two factors that were most commonly seen.

Question 4 (b)(ii)

Many candidates could name Fick's Law and scored the mark. Names of scientists, laws etc mentioned in the specification need learning as they can be used in an exam question.

Question 4 (c)(i)

Candidates generally completed the table accurately, although there were some conversion errors. If the paper does not specify how many decimal places etc to express an answers in, look at the way the other values have been expressed and judge what would be most suitable.

Question 4 (c)(ii)

It was clear from the responses seen that candidates do understand the importance of a short diffusion distance. However, marks were lost by a number of candidates as generic responses were written and not a specific one relating to the actual question being asked.

- (ii) Explain why it is important for body cells to be close to capillaries to meet the demands of respiration.

Use the information in the question and the table to support your answer.

(3)

A shorter diffusion distance means that less time is taken for diffusion, meaning nutrients can reach cells that need them faster, because cells could die due to the lack of constant flow of nutrients and discarding of waste. The cells need to be as close to the capillaries as possible because blood carries oxygen which is needed by cells or they will die, the oxygen will diffuse from the blood into the cells while carbon dioxide will be used up, this is due to the steep concentration gradient and the shorter distance.



ResultsPlus
Examiner Comments

In the first four lines, this response can only be awarded the third mark point as the references to nutrients and waste are too vague for the context of the question. The first two mark points can be awarded in the latter half of the response once oxygen and carbon dioxide have been correctly referenced.



ResultsPlus
Examiner Tip

If the question has a specific context then a generic response is not going to score well; the response must give specifics appropriate to the context being used.

- (ii) Explain why it is important for body cells to be close to capillaries to meet the demands of respiration.

Use the information in the question and the table to support your answer.

(3)

Because if the body cells are not close, the ^{diffusion} distance increases, rate of diffusion decreases, as we can see in the table. As the ~~time~~ diffusion increases from 1um to 10.00 um the time taken for diffusion increases from 0.5 to 4980 milliseconds. This long time taken can cause the cells of being deprived of glucose, less aerobic respiration occurs, less energy released, cell death can occur, diarrhoea, nausea can occur.



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Examiner Comments

This response illustrates one way that the fourth mark point can be awarded.



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Examiner Tip

The instruction to 'use the information in the table to support your answer' is guiding you to make reference to some values in the table that illustrate the increase in diffusion time with an increase in diffusion distance.

Question 5 (a)

This question saw a wide range of responses, mainly due to the level of expression used in candidate answers. Examiners expected there to be confusion between the terms allele and gene as this is a difficult concept for candidates studying biology at this level. Marks were also lost by candidates who did not make it clear which alleles had to be present for a male to have haemophilia or a female to have haemophilia. Some candidates thought that females could only be carriers and not have the disease. Less-able candidates thought that the gene involved was present on the Y chromosomes only.

5 Haemophilia is a group of rare conditions that affects the ability of the blood to clot.

These conditions are caused by mutations in the genes coding for factors involved in the blood clotting process.

- (a) Haemophilia is inherited in a similar way to red-green colour blindness and most people who have it are male.

Explain why most people who have haemophilia are male.

(4)

The gene for haemophilia is located on the X chromosome, and the recessive allele for haemophilia is inherited on the X chromosome. Males only have one X ^{chromosome} ~~chromosome~~, so if they inherit only one recessive allele, it will be expressed and they will inherit ^{haemophilia} ~~haemophilia~~. For females, they need to inherit two recessive alleles to ^{inherit} ~~develop~~ haemophilia, otherwise they will only be carriers as haemophilia is a sex-linked condition.



ResultsPlus
Examiner Comments

This is an excellent response that clearly illustrates all the mark points.



ResultsPlus
Examiner Tip

Make sure you understand the terms 'allele' and 'gene' and that you are clear when to use them. Read through your response to double check you have used each term in the appropriate place.

Question 5 (b)(i)

This calculation was accessible to most of the candidates with many scoring the two marks available.

(b) Two types of haemophilia are haemophilia A and haemophilia B.

In 2021, there were 7.87×10^9 people in the world.

There were 185 218 people with haemophilia A and 37 998 people with haemophilia B.

- (i) Calculate the ratio of people with haemophilia A to those with haemophilia B.
Give your answer to **two** significant figures.

(2)

$$185218 : 37998$$

$$4.87 : 1$$

Ratio **4.87** :1



ResultsPlus
Examiner Comments

As illustrated in this response, there were a number of candidates who did not heed the instructions given in the question and did not express their answer to the required number of significant figures.



ResultsPlus
Examiner Tip

Read all instructions to ensure that you express your answer in the format required to gain full marks.

Question 5 (b)(iii)

There were a number of possible reasons listed in the mark scheme for why the number of people with haemophilia is an estimate. The most common reason given was the idea that there were too many people to test or record.

A similar question in the context of HIV infection has been asked previously and some candidates had clearly seen this question in their preparations for this exam. Examiners did not feel that comments about lying and being ashamed were really suitable for the haemophilia context of this series' question. Using mark schemes to previous series' questions is invaluable but ideas may need modifying slightly if the context of the question is slightly different.

(iii) The number of people with haemophilia is only an estimate.

Give **one** reason why this is only an estimate.

(1)

It is impossible to accurately calculate all people affected by haemophilia because not all cases are recorded



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Examiner Comments

This is a correct common response seen.

Question 5 (c)

The blood clotting story is one that candidates know well and as a result, there were some excellent responses to this question. There were a minority of candidates who wrote everything they knew about the topic and did not tell the effect of reduced thrombin.

- (c) In haemophilia, activation of the blood clotting pathway results in less thrombin being produced than in healthy individuals.

Explain how reduced thrombin will affect blood clotting.

(3)

^{Because}
~~Because~~ if there is less thrombin then less thrombin will bind to fibrinogen. (thrombin is a catalyst / enzyme)
Therefore less ~~fibre~~ fibrinogen will be converted into fibrin.
therefore less mesh will be formed to trap the platelets.
therefore there will be less blood clotting. ~~for blood clotting will be slower~~
(or blood clotting will be slower)



ResultsPlus
Examiner Comments

This candidate has made a concerted effort to ensure that their response addresses the question.



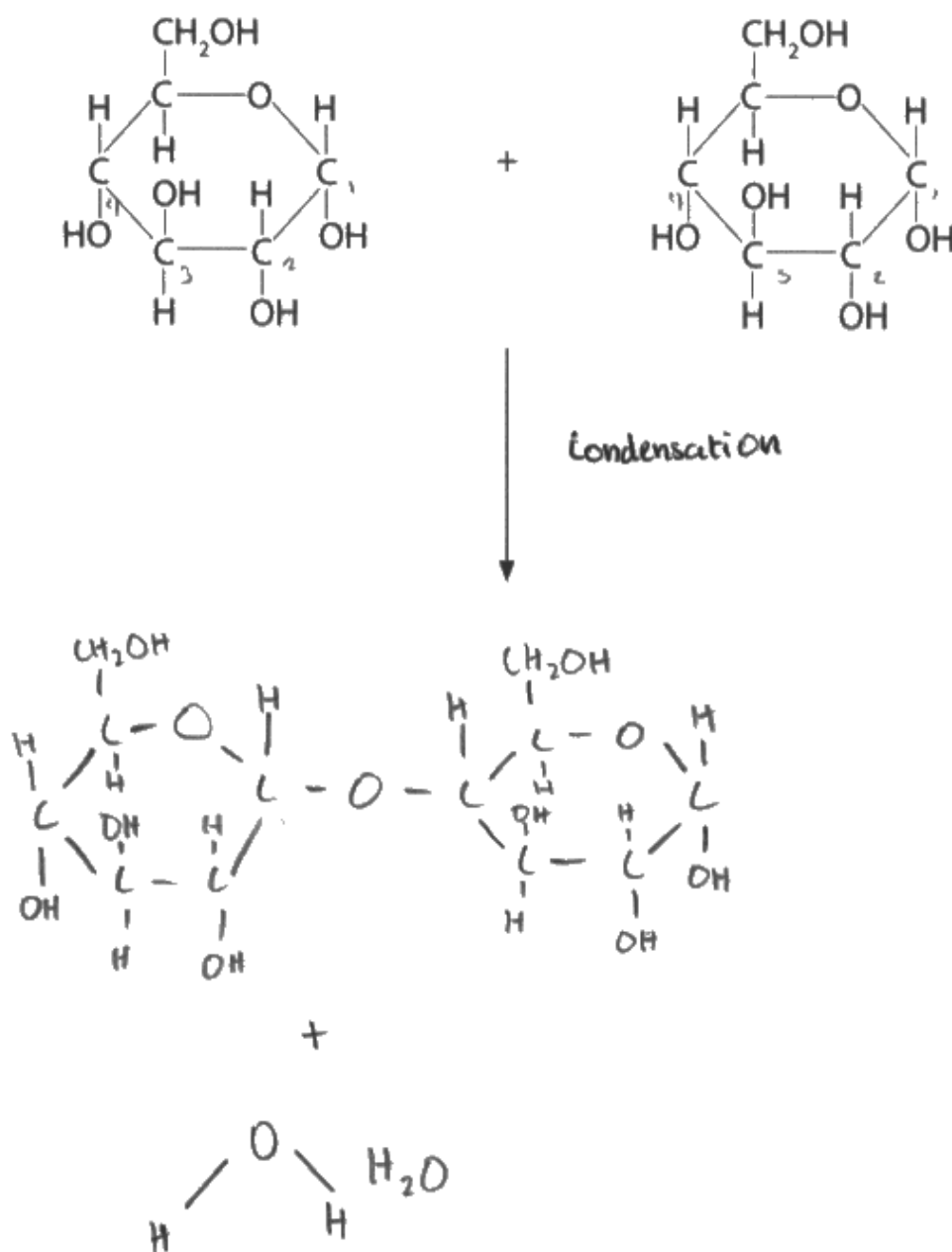
ResultsPlus
Examiner Tip

You are more likely to be asked to apply your knowledge to a context than simply regurgitate it. Always read the question carefully to identify that context before writing your answer.

Question 6 (a)

Candidates have been asked in the past to complete a diagram to show a glycosidic bond. Not enough care had been taken in completing the whole diagram accurately resulting in the dropping of a mark. It's pleasing to say that it felt this series as though more responses were being assigned the full three marks. The commonest error still however was to miss the H off of C5.

Complete the diagram to show how these two molecules join by a glycosidic bond to form **two** products.





An example of a response scoring full marks.



You may be asked to draw diagrams to show the bonds joining monomers together to form a named polymer in the specification. These need practicing in the run up to the exams.

Question 6 (b)(i)

Candidates generally picked up one mark for drawing one of the two possible disaccharides that could be formed following the digestion of this molecule.

Draw **one** disaccharide and **two** different oligosaccharides that could be produced following the digestion of this part of amylopectin by this amylase.

(2)



ResultsPlus
Examiner Comments

This scores both available marks.

Question 6 (b)(ii)

Surprisingly, the number of candidates who realised that this question was testing them on enzyme specificity was quite low. Some of those who did realise wrote generic answers and did not mention the 1-4 glycosidic bonds in their answer or did not appreciate that the bonds were the substrate and not the whole molecule.

(ii) Explain why this amylase is able to break only 1–4 glycosidic bonds.

(2)

Because it can bind only to catalyse hydrolysis of 1,4 glycosidic bond, that is because it has a very specific shape of active site complementary only to one substrate.



ResultsPlus
Examiner Comments

An example of a clear response to this question.



ResultsPlus
Examiner Tip

When writing about enzyme action there are some key words to use that include active site, specificity, complementary, substrate, enzyme-substrate complexes.

Question 6 (c)(i)

This is another question testing enzyme specificity and the idea that a different substrate will need a different enzyme, in this case, the two types of glycosidic bonds are the two different substrates.

Give reasons for your answer.

(3)

- Both disaccharides and oligosaccharides are broken down into smaller units by enzymes.
- This is because to be absorbed, they need to be small enough to dissolve into blood stream.
- In order to be broken down, bonds must be broken
- Therefore enzymes with active sites complementary to 1,4 glycosidic bonds break down 1,4 glycosidic bonds in disaccharides and oligosaccharides, while enzymes with active sites complementary to 1-6 glycosidic bonds break 1-6 glycosidic bonds in oligosaccharides.



ResultsPlus
Examiner Comments

This candidate drops a mark because they did not name the type of breaking down process that took place i.e. hydrolysis.



ResultsPlus
Examiner Tip

Be as specific as you can in your responses. If you are meant to know the name of a bond for example, then name it. If you are meant to know the name of a type of reaction, then name it.

Question 6 (c)(ii)

For this question most candidates gave the first mark point and then simply stated that the phospholipids were non-polar without explaining that the glucose could not actually pass through these molecules.

Explain why glucose cannot diffuse into the bloodstream.

(2)

Because it is a polar molecule and fatty acid tails are not polar therefore glucose cannot pass through the fatty acid tails of the membrane. ~~It cannot enter. It can enter~~
It can enter by facilitated diffusion it needs a protein to provide a polar channel that it can move through.



This response demonstrates the essence of the two mark points.

Question 7 (a)

This was another accessible calculation where the candidates who did not score both marks were generally those who did not follow the instructions to express their answer to two decimal places.

Calculate the mean rate of production of monacolin K in this culture, in the 45-day time period.

Give your answer to **two** decimal places.

(2)

$$\frac{340}{45} = 7.56$$

Answer ~~7.56~~ 7.56 mg per 100g of rice per day



ResultsPlus
Examiner Comments

An example of a candidate reading the instructions and giving their answer to two decimal places.



ResultsPlus
Examiner Tip

You must follow the instructions on how to express your answer to score full marks.

Question 7 (b)

Many candidates are now well-schooled on how to approach these levels-based questions. This was evident in many of the responses where candidates wrote about the data in the table first, followed by that in graph 1 and that in graph 2.

The less-able candidates are still only describing the data shown (level 1). Many candidates could describe a couple of limitations, mostly focussing on the inconsistent data shown in the table and the overlapping range bars (level 2).

Few candidates fully-understood what was expected of them from the question so we saw only a relatively low number of responses linking in the limitations with conclusions that could be made from the data (level 3).

Many candidates do not appreciate when to use terms like reproducible, accurate and valid, which was particularly important in this question as a number of the limitations in this data meant that valid conclusions could not be drawn. Some candidates are still using the term reliable when they should not be.

Discuss the limitations of using the results of these studies to draw conclusions about the effects of RYR on lipid levels.

(6)

In the table, no data is available for studies 3 and 4 for the change in HDL cholesterol, ~~which~~ making the data inconclusive. It also lacks a control group that did not eat RYR, so their results lack validity as there is no certainty that the outcomes ^{of lipid levels} are due to the consumption of RYR or occur naturally. Graph 1 ~~has not been~~ shows that the study was only conducted for 10 weeks, therefore ~~the~~ it is unknown if eating RYR to reduce lipid levels ~~is~~ can be used as a long term solution. The time axis in graph ~~is~~ 2 is not labelled, so it is also unknown if the results state that RYR is a long term and consistent solution for reducing lipid levels. The volume of RYR eaten is also unknown, decreasing the study's reliability.



This response is a clear and succinct example of a level 3 response and also illustrates that a candidate does not have to write pages to score highly.

Question 7 (c)(i)

The mark scheme provides a long list of the side effects that can be caused by taking statins. Candidates tended to opt for nausea, fatigue, muscle pain, liver damage and kidney failure.

There were some candidates who confused the side effects with other types of medications.

(c) Treatment with statins can have side effects.

(i) Name **two** possible side effects of being treated with statins.

- 1 Nausea
- 2 Fatigue



ResultsPlus
Examiner Comments

An example of a correct response.



ResultsPlus
Examiner Tip

Learn two or three side effects for the four groups of medications listed on the specification; you do not have to learn several for each.

Question 7 (c)(ii)

A surprising number of candidates did not state that the side effects would be monitored. Candidates must make sure they are answering the question that is being asked.

(ii) Describe how an investigation could be designed to identify any side effects of treatment with monacolin K.

(4)

- use large sample size
- 2 large groups / Same gender and mass and from the same region.
- use 2 ^{different} groups with ~~for~~ 2 different treatments
- over a period of time / 6 months
- monitor one test cholesterol levels / blood pressure and other side effect.
- make a conclusion.
- repeat for reliability.
- make sure no other medication are given.



There were some very good responses to this question, one of which is illustrated here. This candidate could be awarded most of the mark points but is too vague in describing what the groups were given and does not mention statistical analysis.

(ii) Describe how an investigation could be designed to identify any side effects of treatment with monacolin K. ✓

(4)

Large sample of people, that have
no underlying ~~bad~~ health risks

One group given monacolin K, other
group given a different statin and
one group with placebo

Control factors like diet & medication
track side effects over long period
of time



ResultsPlus
Examiner Comments

Another example of a response that demonstrates most of the mark points.

Question 7 (c)(iii)

The mark scheme covers a range of possible suggestions and they were all given in the responses seen. However, the most common ones were mark points four and six.

- (iii) Suggest **two** problems when assessing possible side effects resulting from treatment with monacolin K in an investigation.

(2)

1 might not get accurate results, because not all patients may show the same side effects

2 some side effects don't show from the outside of the body, or the patient is not aware of it



An example of the most common suggestions given by candidates.

(iii) Suggest **two** problems when assessing possible side effects resulting from treatment with monacolin K in an investigation.

(2)

- 1 Side effects might not occur in all people, but only in some, so certain groups might be more sensitive and prone to side effects. Side effects might result from another factor, and not from monacolin K.
- 2 Side effects might harm the participants and cause long term health issues so its unethical.



ResultsPlus
Examiner Comments

This response also illustrates mark point five. Although a number of candidates mentioned ethics, few qualified their answers with a reason as to why it was unethical.

Question 8 (a)

The least frequently awarded mark point was the third one. Candidates knew that 'iron' was present but tended not to state that it is the iron ion.

(a) Describe the structure of a haemoglobin molecule.

(3)

A haemoglobin molecule is a quaternary protein formed by 4 polypeptide chains, 2 α globin and 2 β globin. Each polypeptide contains a prosthetic haem group which is a charged Iron ion (Fe^{2+}) allowing for the binding of 4 oxygen molecules or 8 oxygen atoms in 1 haemoglobin molecule (each haem group holds 1 molecule). The polypeptide chains are held together by ionic, hydrophobic, disulphide peptide bonds and hydrophobic interactions being composed of aspartic, serine and amino acids.



ResultsPlus
Examiner Comments

This is a very comprehensive answer and illustrates the three mark points that specifically pertain to the structure of haemoglobin.



ResultsPlus
Examiner Tip

When naming a particular element in your answer you must state that it is in the form of an ion if appropriate.

Question 8 (b)

This levels-based question is probably more challenging for candidates as many did not pick up on the fact that examiners were after relationships between (trends in) the sets of data. Many candidates wrote four sections in their answer, one for each of the mammals listed in the table (level 1). The more astute candidates immediately spotted the most clear-cut trend between the size of the mammal and the oxygen-carrying capacity, immediately raising their response to a level 2. The command word in this question is 'explain' so some explanation of the relationships given raises the level of the response to a 3.

Use the information in the table to support your answer.

Generally, the number of red blood cells per dm^3 of blood⁽⁶⁾ seems to increase slightly as size decreases. At the exception being the camel. The goat has the highest red blood cell per dm^3 blood and the beluga like the largest respiratory surface like the elodon red blood cells per dm^3 blood. The mean mass of haemoglobin decreases with increases as organism size increases, which is expected as larger organisms need more haemoglobin for Hb to carry O_2 for respiration. The oxygen carrying capacity also seems to follow this trend as larger organisms need more O_2 for respiration due to having much larger tissues carrying more O_2 for respiration. The beluga like can carry the most O_2 and carries the most haemoglobin while the camel value decreases with size, the smaller camel is an anomaly carrying much more haemoglobin than expected. The beluga like ($3.9 \times 10^{14} \text{ g m}^{-3}$), suggesting as size decreases the haemoglobin content of the oxygen capacity increases due to the increase in cell volume with the exception being the camel. Smaller animals also seem to have a greater concentration of red blood cells in the blood at the same length of the exception, and there is no correlation between the mass of haemoglobin and size unless the camel is the anomaly carrying the highest or less than expected.



This response describes a couple of relationships shown in the data and offers some explanation, which is what is required for level 3.



The individual components of the question need identifying before attempting your answer. You can see that this candidate has underlined these which has helped them to write a high-scoring response.

I would have circled or underlined the command word as well.

Use the information in the table to support your answer.

(6)

As the size of the mammal decreases, the oxygen-carrying capacity also decreases. This is because the smaller the mammal the lower the metabolic rate, thus the less oxygen required. As the mean ~~size~~^{mass} of red blood cells, (R.B.C.) ~~increases~~, the mean number of R.B.C. decreases.

This is because less R.B.C. are needed to carry the same volume of oxygen, if ~~each~~^{each} R.B.C. can carry more oxygen. The mean cell volume decreases with decreasing size, except for camels. Oxygen is needed for aerobic respiration to release energy in the form of ATP for muscle contraction. Whales move a lot as they swim, and ~~need~~ need a lot of oxygen for a lot of muscle contraction. They have a low surface area to volume ratio, while goats have a higher surface area to volume ratio, so ~~whales~~^{and larger mammals} can get less oxygen from diffusion alone than goats, and smaller mammals. Whales have less red blood cells than camels, as whales have a lot of oxygen dissolved in the water, coming in contact with their large body. Goats live at higher altitudes than men, where there's less partial pressure of oxygen, so goats need and have more red blood cells than men. They also have less cells for smaller diffusion distance and for smaller volume, to increase their surface area to volume ratio, for faster exchange of oxygen and rate of diffusion.



This particular candidate has stated the most obvious relationship in lines 1 and 2 which immediately lifts this response into a level 2 category. The simple explanation that follows secures a top level 2 mark.

The rest of the response raises this into a level 3.

Question 8 (c)(i)

Having to calculate a decrease when values are given as percentages confused some candidates, resulting in them using the values read from the graph to calculate a percentage.

- (i) The decrease in percentage saturation with oxygen of myoglobin from 6 kPa to 4 kPa is 3%.

Calculate the difference between this decrease and the decrease for haemoglobin from 6 kPa to 4 kPa.

(2)

$$76 - 50 = 26\%$$

$$26\% - 3\% = 23\%$$

Answer 23 %



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Examiner Comments

An example of a response scoring full marks.

Question 8 (c)(ii)

Understanding the oxygen-dissociation curve is not an easy concept particularly as a description of the biology it represents requires the curve to be read from right to left.

The vast majority wrote their answers by describing the changes that occurred as partial pressures of oxygen increased. We decided to allow this, provided it was clear that they were writing about the binding of oxygen and not it's dissociating.

Many candidates did not score particularly well in this question as they did not follow the instruction to use values from the graph to support their answer. Many candidates simply described the overall trend and little else. Other common errors were to compare the myoglobin curve to that of the haemoglobin, and to refer to the gradients of the line components in terms of rate.

- ✎ (ii) Describe the effect of the partial pressure of oxygen on the percentage saturation with oxygen of myoglobin.

Use values from the graph to support your answer.

(2)

The higher the partial pressure of oxygen/kPa, the higher the percentage saturation with oxygen of myoglobin. From 0 kPa to 1 kPa, there is a steep increase in percentage saturation with oxygen. After 1 kPa, the percentage saturation with oxygen continues to rise, but levels off.



ResultsPlus
Examiner Comments

This candidate starts their response in the same way as the vast majority of candidates did, by stating the overall trend. The response then goes on to describe the steep section and plateaued section of the graph using values, which gains them the two marks.



ResultsPlus
Examiner Tip

The gradient of a line is not a rate unless time is along the x axis.

Question 8 (c)(iii)

An encouragingly high number of candidates identified that myoglobin had a higher affinity for oxygen than haemoglobin. Fewer candidates could suggest the significance of this; both mark points two and three were seen but mark point two more rarely.

(iii) Suggest why the dissociation curve for myoglobin is to the left of the curve for haemoglobin.

(2)

- Myoglobin ~~are~~ have higher oxygen affinity than haemoglobin,
- it's more ~~easy~~ to take an oxygen than haemoglobin
- As myoglobin found in muscle, require more oxygen to aerobic respiration to release energy.



This illustrates mark points one and three. Mark point three is not written that clearly but is sufficient enough to gain the mark.

(iii) Suggest why the dissociation curve for myoglobin is to the left of the curve for haemoglobin.

(2)

The oxygen in myoglobin should only be released ~~at~~ in strenuous activity, when the muscles cannot get enough oxygen from haemoglobin, so oxygen is not released until very low P_{O_2} . When O_2 store in myoglobin is depleted, it also should have ability to be restored via absorbing O_2 from haemoglobin so it requires a higher affinity for O_2 .



ResultsPlus
Examiner Comments

This is a clearer response and illustrates all three of the mark points.

Paper Summary

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

- In the maths questions, pay attention to how to express values – if you are given instructions on how to do this then these need following but if there are no instructions then look at the values given in the question and select a suitable format.
- Appreciate the differences in the meanings of terms such as validity, repeatable, accurate etc and understand when each term should be used.
- You need to be able to describe what the significance of error bars in terms of the effect of one variable on another variable.
- When describing data shown in a graph or table, an overall description should be given as a starting point and then the individual trends described separately.
- When describing what a gradient in a graph represents, terms relating to rate and speed are only appropriate if the values on the x axis relate to time, otherwise expressions like shallow, steep, plateaux maybe more appropriate.
- In the majority of levels-based questions, simply describing actual data will not score above a level 1 response so do not describe absolutely every aspect; make three or four points that covers all visuals shown. Check the command word to see what is required by the question so that access to the higher levels is possible.