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Examiners' Report
June 2022

International A Level Biology WBI11 01

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June 2022

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Introduction

This paper was fairly typical of previous WBI11 papers.

In the responses to the more frequently covered topics there was evidence that candidates had been well prepared for the exam using past paper mark schemes.

There was only one levels-based question in this paper. A range of responses were seen on this question with some candidates clearly schooled on how to approach such a question.

The paper also included the statutory eight multiple choice questions which saw a range of responses but none appearing to cause any problems for candidates.

However, the one question that candidates found most challenging was the final question, Q8. Candidates had to work out the probability for an individual having PKU and then halving it as the question had asked for males specifically being affected.

The paper also contained the minimum statutory number of maths marks. Candidates appeared to be better prepared for these questions as there were signs of improvements, especially in calculating ratios.

Question 1

This question was a straightforward start to the paper with many candidates scoring 4 or 5 marks. Probably the commonest error was in the fourth gap where condensation was confused with hydrolysis but we did see some responses where solute was confused with solvent in the third gap. A lot of candidates wrote polar instead of dipolar in gap one, which we allowed but would prefer to see water referred to as a dipolar molecule.

1 Water is an important biological molecule.

Read through the following description of water.

Complete the description by writing the most appropriate word on the dotted lines.

Water has an uneven charge distribution so it is described as a

di polar molecule. The hydrogen ends of the molecule

have a very slightly positive charge.

Water is involved in the transport of substances so it is an important

Solvent in living organisms.

Water is needed in chemical reactions called hydrolysis

reactions that break down disaccharides such as

~~maltose~~ lactose into glucose and galactose.

ResultsPlus
Examiner Comments

This response was awarded the full 5 marks.

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Examiner Tip

As general advice on gap-fill questions, it is good practice to read the passage thoroughly before attempting to write the answers.

Question 2 (d)

This question took a slightly different angle to questions in previous series in order to determine candidates understanding of the reason for storing thromboplastin inside platelets.

Some candidates wrote everything they knew about the blood clotting process which did not score highly. However, they were able to achieve some marks for the last marking point.

The better responses provided an explanation as to how this stopped prothrombin being converted into thrombin (mark point 2) and therefore preventing the clotting process (mark point 3). Very few responses included the first mark point.

(d) Thromboplastin is stored inside platelets.

Explain the advantages of storing thromboplastin inside platelets.

(3)

Thromboplastin can be released only when required as otherwise thromboplastin converts prothrombin into thrombin, initiating the blood clotting process as prothrombin is ~~soluble in~~ present in blood plasma.

Blood clot can block the capillaries leading to the lack of oxygen.

ResultsPlus
Examiner Comments

This response illustrates marking points 2, 3 and 4. In fact, marking point 4 was awarded as it is in the context of what would not happen.

ResultsPlus
Examiner Tip

Read the question carefully in order to write a response that meets the expectation of the question. The response to the question has to be written in such a way that it matches the context of the question.

Question 3 (b)

This question asked candidates to explain why enzymes are defined as 'biological catalyst'. This is a term that is specified in the specification for this qualification and candidates should be expected to define these terms accurately. Many responses only scored for marking point 2 as the description of 'biological' had not been included in the answer.

(b) Explain why enzymes are described as biological catalysts.

(2)

Enzymes are proteins produced naturally in living organisms thus biological. They speed up reactions by lowering the activation energy without being used up in the reaction, thus catalysts.

ResultsPlus
Examiner Comments

This is an illustration of a thorough definition. This response clearly defines each component of the term, ie biological and catalyst and it was awarded the full 2 marks.

ResultsPlus
Examiner Tip

If a question asks for a definition of a term, then each word in the term needs defining.

Question 3 (c)(i)

This mathematical question required candidates to carry out a standard calculation but the mark was lost in responses which did not give the answer to two significant figures.

(i) Calculate the effect on the rate of reaction of each degree increase in temperature between 46 °C and 50 °C.

Give your answer to two significant figures.

(1)

$\frac{20 - 54}{50 - 46} = -8.5$ au per °C

Answer −8.5 a.u. per °C

ResultsPlus
Examiner Comments

In this response, the candidate attempted to indicate that there was a drop in rate between 46 ^{o} C and 50 ^{o} C. This was not actually needed for the mark but certainly did not count against them. This response was awarded the 1 mark.

ResultsPlus
Examiner Tip

It is important that the necessary mathematical skills are learnt as well as the Biology content for this qualification. Always double check if there is an instruction in the question stating how many decimal places or significant figures should be used. If there is no such instruction then you have to decide on a suitable number of decimal places or significant figures in which to express the answer.

Question 3 (c)(ii)

This question asked candidate to explain the effects of temperature on enzymes. The majority of candidates provided an accurate response. However, some candidates lost the mark for lack of clarity in their writing which did not communicate the answer adequately.

(ii) State why there is a decrease in the rate of reaction above the optimum temperature.

(1)

The enzyme denatures and no longer binds to substrate.

ResultsPlus
Examiner Comments

This is an example of a good quality response which was awarded full marks.

ResultsPlus
Examiner Tip

Avoid stating that an enzyme 'starts' to denature above the optimum temperature. The rate of reaction of an enzyme is a combination of the frequency of collisions and the distortion of the active site. The active site gets distorted due to vibrations of the R groups at temperatures below the optimum but this is compensated by the increase in collisions up until the optimum temperature.

Question 4 (a)

This question required candidates to analysis the data provided in the table to select the appropriate values to use in their calculations. Candidates were also expected to take note of the data in the table to decide on the number of decimal places or significant figures they should use and the format for their answer.

4 The structures of blood vessels relate to their functions.

The table gives information about some blood vessels in a dog.

Blood vessel	Number in body	Diameter / cm	Length of vessel / cm	Total surface area / cm^2	Velocity of blood flow / $cm\ s^{-1}$
aorta	1	1.0	40.0	1.3×10^2	28.0
large arteries	40	0.3	20.0	7.5×10^2	7.8
capillaries	1.2×10^9	8.0×10^{-4}	0.1	3.0×10^5	3.6×10^{-2}
large veins	40	0.6	20.0	1.5×10^3	1.9
vena cava	1	1.25	40.7	1.6×10^2	18.0

(a) Complete the table.

Use the formula:

surface area = $2\pi rl$

where r is the radius of the blood vessel and l is the length of the vessel.

(3)

surface area $= (2 \times \pi \times 0.3 \times 20) \times 40$
$= 1.5 \times 10^3$

length $= \frac{\text{surface area}}{2\pi r} = \frac{1.6 \times 10^2}{(2 \times \pi \times 0.625)}$

40.7

ResultsPlus
Examiner Comments

The majority of candidates coped well with this question with a reasonable proportion showing their workings in the space provided and then writing their answer in the table, as shown in this example. If the answer was clearly shown in the workings but not transposed to the table, the full marks were still awarded.

4 The structures of blood vessels relate to their functions.

The table gives information about some blood vessels in a dog.

Blood vessel	Number in body	Diameter / cm	Length of vessel / cm	Total surface area / cm^2	Velocity of blood flow / $cm\ s^{-1}$
aorta	1	1.0	40.0	1.3×10^2	28.0
large arteries	40	0.3	20.0	7.5×10^2	7.8
capillaries	1.2×10^9	8.0×10^{-4}	0.1	3.0×10^5	3.6×10^{-2}
large veins	40	0.6	20.0	37.7	1.9
vena cava	1	1.25	40.7	1.6×10^2	18.0

(a) Complete the table.

Use the formula:

surface area = $2\pi rl$

where r is the radius of the blood vessel and l is the length of the vessel.

(3)

$2\pi \times 0.3 \times 20$

$2 \times \frac{22}{7} \times 0.625 \times l = 1.6 \times 10^2$

$l = \frac{1.6 \times 10^2 \times 7}{2 \times 22 \times 0.625}$

ResultsPlus
Examiner Comments

Calculating the surface area of one vein and not the total surface area of all the veins was a common error, as shown in this response. Candidates were awarded one of the two marks for this part of the calculation.

ResultsPlus
Examiner Tip

Always attempt the calculations, particularly those worth more than one mark as there will be method marks available, even if the final answer is incorrect.

Question 4 (b)

In this question, candidates were required to apply their knowledge about the structure and function of blood vessels. The majority of responses demonstrated that candidates knew what was expected of them from the question and there were some very good answers.

(b) Explain why the velocity of blood flow in the large arteries is slower than the velocity of blood flow in the aorta.

(3)

There are more large arteries than aorta where the total cross-sectional ~~surface~~ area of large arteries is larger since large arteries are more heavily branched. The blood flow (velocity of) in large arteries ~~are~~ is thus lower. Blood is just pumped out of the left ventricles into the aorta where blood pressure is higher in the aorta, causing blood flow in aorta to be faster. The velocity of blood flow decreases as blood flows along the arteries ~~since~~ due to friction between blood flow and the artery wall.

ResultsPlus
Examiner Comments

This is a clear, concise explanation that illustrates the first three marking points. The question expected candidates to provide responses about the large arteries but marks were awarded for the opposite for clear accounts of the aorta.

ResultsPlus
Examiner Tip

Use the marks allocated to a question as a guide to how much to write. In a question like this, if there are three marks available then three explanations are needed.

Question 4 (c)

This question was asking about the structure and function of capillaries. Candidates clearly knew that various molecules had to diffuse into the cells and that diffusion needed to be faster. However, few candidates appreciated that plasma actually leaves the capillaries and that the diffusion is from the tissue fluid and into the cells. Therefore, the first marking point was rarely awarded.

(c) Explain why the total surface area of the capillaries needs to be so high.

(2)

Through capillary the diffusion of gases and food particles takes place. So to ~~increase the diffusion~~ decrease the diffusion distance and increase the rate, surface area is more. Also it decreases the diffusion time. So faster diffusion.

ResultsPlus
Examiner Comments

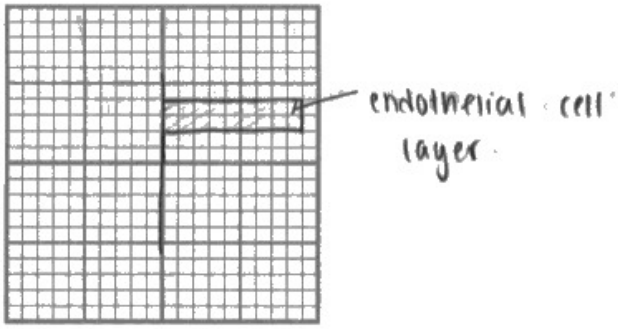
This is an example of a good response and it scored for marking points 2 and 3. However, the majority of candidates only scored for marking point 2.

Question 4 (d)(ii)

In this question, part D still focussed on the structure of blood vessels but in a different format than in previous examination series. The majority of candidates attempted this question and were confident with this different format. However, a number of diagrams were not in the style used in the multiple choice question but the mark scheme allowed for this.

(ii) Draw a diagram, using the style above, to represent the wall of a capillary.

(1)

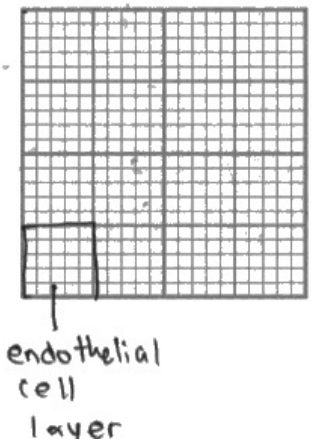


ResultsPlus
Examiner Comments

Quite a few candidates labelled their diagram which confirmed clearly what they had drawn. This example shows a single bar clearly labelled, even though it is not drawn where it should be.

(ii) Draw a diagram, using the style above, to represent the wall of a capillary.

(1)

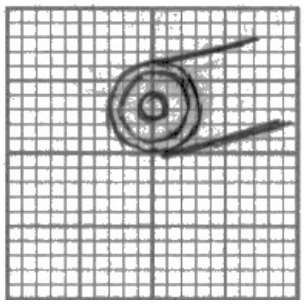


ResultsPlus
Examiner Comments

This candidate has not used the style of our diagram but it is clearly showing just one bar. The response was awarded the mark.

(ii) Draw a diagram, using the style above, to represent the wall of a capillary.

(1)



ResultsPlus
Examiner Comments

This candidate has attempted to draw a diagram of a capillary which did not meet the expectation of the question. This response was awarded no marks.

ResultsPlus
Examiner Tip

Read the question carefully and follow the instructions given.

Question 5 (a)(i)

In this question, candidates were expected to write specifically about collagen. The mark scheme provided opportunities to award the general characteristics of fibrous proteins that could be identified specifically from descriptions of collagen.

5 Hair straightening, or rebonding, is a hair styling technique used to straighten hair using either heat or chemicals.

(a) Hair is made from an insoluble fibrous protein called keratin.

(i) Describe **two** structural features of insoluble fibrous proteins.

(2)

1 long parallel polypeptide chains held together by hydrogen bonds, repeating sequence of proline, glycine and hydroxyprolin

2 Triple helix with α chains, with hydrophobic R group.

ResultsPlus
Examiner Comments

This is a very good description of collagen which identifies the long chains (mark point one), the hydrogen bonds (mark point 4) and the repeating sequences of amino acids (mark point 2), which are the characteristics of fibrous proteins. This response was awarded the full 2 marks.

ResultsPlus
Examiner Tip

Do not be put off by contexts or examples that are unfamiliar. Identify the topic area and then use the information that you have been taught to answer the question. In this question, keratin may not be familiar to candidates but collagen is a fibrous protein that is taught as part of this specification. Therefore, use your knowledge of collagen to answer the question.

Question 5 (a)(ii)

In this question, candidates were required to draw the complete structure of the amino acid, cysteines. Although candidates were not expected to know the structures of specific R groups they are expected to know the structure of an amino acid, including where the R group is attached.

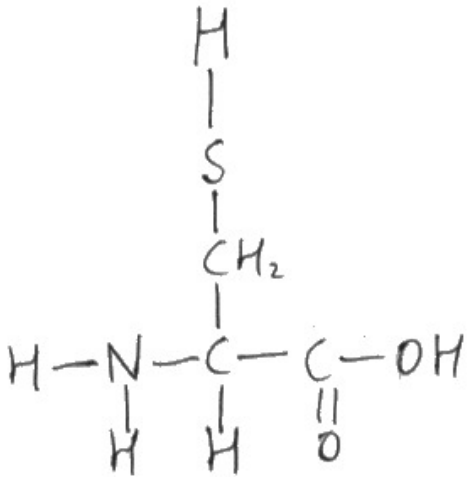
(ii) Keratin contains a high proportion of the amino acid, cysteine.

Disulfide bridges form between the R groups of two cysteines.

The diagram shows the R group of cysteine.

Draw the complete structure of the amino acid, cysteine.

(3)



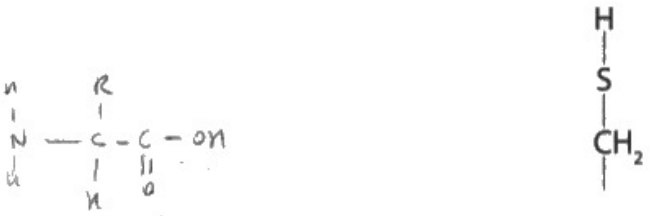
ResultsPlus
Examiner Comments

This is an example of a response that was awarded the full 3 marks.

(ii) Keratin contains a high proportion of the amino acid, cysteine.

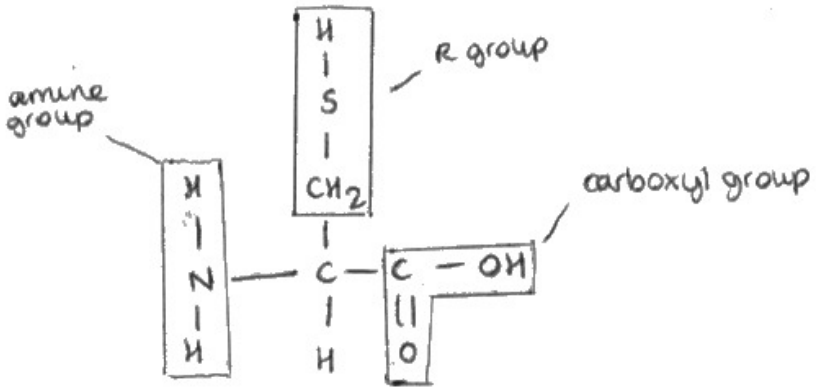
Disulfide bridges form between the R groups of two cysteines.

The diagram shows the R group of cysteine.



Draw the complete structure of the amino acid, cysteine.

(3)



ResultsPlus
Examiner Comments

This candidate has provided a very detailed response which goes beyond the expectations of the mark scheme. The response was awarded the full marks.

ResultsPlus
Examiner Tip

Although your answers should be clear, you must be careful not to spend too much time on a question doing too much unnecessary work.

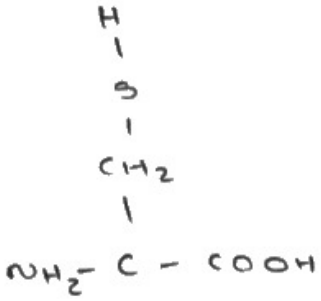
(ii) Keratin contains a high proportion of the amino acid, cysteine.

Disulfide bridges form between the R groups of two cysteines.

The diagram shows the R group of cysteine.

Draw the complete structure of the amino acid, cysteine.

(3)



ResultsPlus
Examiner Comments

This is an example of one of the most frequent errors made on this question. It shows a hydrogen missing from the central carbon atom. It was awarded 2 marks.

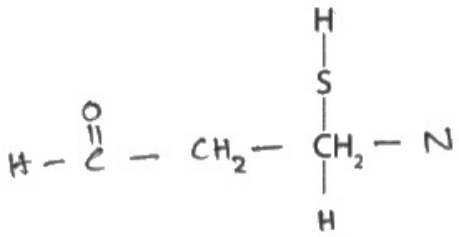
ResultsPlus
Examiner Tip

You are expected to be able to draw the structure of certain molecules. You should know that carbon needs four covalent bonds, oxygen and nitrogen both need two bonds and hydrogen just one bond. A quick count up may save a mark.

(ii) Keratin contains a high proportion of the amino acid, cysteine.

Disulfide bridges form between the R groups of two cysteines.

The diagram shows the R group of cysteine.



Draw the complete structure of the amino acid, cysteine.

(3)

ResultsPlus
Examiner Comments

A few candidates selected to complete the diagram instead of drawing the amino acid in the space. Although there are no marks for this particular diagram, a candidate could still gain all three marks.

ResultsPlus
Examiner Tip

Our instructions should be followed.

Question 5 (b)(i)

This question was intended to introduce the context of secondary structure in preparation for candidates' explanation of the data shown in the table.

(i) Describe the secondary structure of a polypeptide.

(2)

The secondary structure of polypeptide consists of the primary structure being coiled and folded repeatedly along it's length and being held together by hydrogen bonds. It often forms into an α helix or a β pleated sheet.

ResultsPlus
Examiner Comments

This response illustrates both mark points and it was awarded the full 2 marks.

ResultsPlus
Examiner Tip

The hydrogen bonds that hold the secondary structure together do not form between the R groups. This is a common misconception.

Question 5 (b)(ii)

The data in the table is relatively straightforward but the explanation required candidates to apply their knowledge of both primary and secondary structures and the effect of temperature on bonds.

Some candidate responses tended to describe the data but did not offer any explanation. These responses were only able to access marking point 1.

However, very few candidates were awarded the last marking point despite it being included in previous mark schemes related to questions about the effect of temperature on protein structure.

(ii) Explain the results of this investigation.

(4)

No change in primary structure since this structure only consists of amino acids joined by peptide bonds in a long chain, and ~~high to~~ this increase in temperature is not enough to break the peptide bonds between these amino acids, so the length doesn't change. In the secondary structure, the chain is folded and made shorter with the help of hydrogen bonds, so increasing temperature can break these bonds (weaker than peptide bonds), so the chain looses its 3D structure and can become and unfolded chain ~~made~~ making it longer.

ResultsPlus
Examiner Comments

This response provides a detailed answer and it was awarded the full 4 marks.

ResultsPlus
Examiner Tip

Questions with the command word 'explain' require candidates to write scientifically about the data given. You should use words such as, 'therefore', 'because' or 'as a result'.

Use the marks allocated in the question to guide you in how much to write. For example, this question was worth four marks so at least three, if not four, explanatory points need to be made.

Question 6 (a)(i)

A large part of the specification covers cardiovascular disease (CVD) and the study of its design and interpretation. Question 6 was designed to cover a number of aspects of this topic area.

The first part of the question required candidates to provide two conclusions that could be made from the data. In general, candidates find describing conclusions quite challenging. For example, candidates can describe data but find it much harder to identify significant trends that form a basis of a conclusion.

The majority of candidates were able to describe the conclusions given for marking point 1. However, many candidates stated the reverse for the overweight category by not appreciating the similarity of the data for perceived and actual risk.

Many candidates wrote about the numbers of people who were overweight and were unable to write coherently to be awarded marking point 3.

(i) Describe **two** conclusions that can be drawn from this study.

(2)

1 The number of people with an actual risk was always higher than perceived risk, except ~~other~~ risk factor of 'overweight'. getting CVD from

2 As a whole, the risk factor of smoking was the least out of all other factors.

ResultsPlus
Examiner Comments

In this response, marking points 1 and 3 were awarded.

ResultsPlus
Examiner Tip

When describing conclusions you need to be looking for overall patterns or trends in data and not describing individual aspects of the data.

Question 6 (a)(ii)

This was a similar question to previous series to understand candidates' knowledge of the design of studies. In this question, candidates were required to provide an explanation for the design of this particular study. However, many candidates overlooked the command word 'explain' and tended to list a number of control variables.

(ii) Explain how this study should have been designed to allow valid conclusions to be made.

(3)

→ Take people of same age, ~~and~~ gender and diet.

→ Include more number of people.

→ Use standard deviation.

ResultsPlus
Examiner Comments

This response was awarded marking points 1 and 2. However, although bullet points are credited, the preferred response would have been to provide a link between more people and the fact that this would allow for some statistical analysis to be performed.

ResultsPlus
Examiner Tip

If you are answering in bullet points, make sure there is enough information in them to be creditworthy.

(ii) Explain how this study should have been designed to allow valid conclusions to be made.

(3)

* The ~~sample~~ number of people should be increased. Sample size should be increased, to make it more valid over a study and increases reliability.
* The ~~sample~~ should show their sex. If its a male or female, because it also plays a role in CVD.
* ~~Sex~~ study should show their age. because age plays a big role in CVD as age increases risk of CVD increases.
* ~~Q~~ should be ~~written~~ asked if they are heavy smokers or light smokers because ~~heavy~~ heavy

ResultsPlus
Examiner Comments

This candidate has tried to give reasons but does not provide a good interpretation of the word 'valid' in this context. In addition, the word 'reliability' is not appropriate in this context.

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Examiner Tip

The word 'reliability' should be replaced with either "repeatable' or 'reproducible', depending on the context.

You do need to learn the difference between these two terms, as well as 'accurate', 'precise' and 'valid' so that you can use each term correctly. They all have different meanings and are not interchangeable.

Question 6 (a)(iii)

There were some good attempts at answering this question but the less successful responses tended to list lifestyle changes without an explanation. The more successful responses offered explanations and tried to cover different aspects but very few actually covered three different aspects. Therefore, full marks for this question were rare.

(iii) Explain why it is important that a person's perception of a risk is close to the actual risk.

(3)

It's important because [redacted] then they would start taking the necessary precautions to decrease their risk by being more active / eating healthier with less salt and saturated fats and smoking less.

If they underestimate their risk they will continue doing the activity that increases their risk and increase their risk even more.

Overestimating their risk of CVD will cause stress which will increase actual risk.

ResultsPlus
Examiner Comments

This is an example of a response that provides an explanation of two different aspects and it was awarded two marks for marking point 1 and marking point 3.

ResultsPlus
Examiner Tip

Questions with the command word 'explain' require candidates to give a reason for each of their ideas.

A 3-mark question requires candidates to give three different ideas.

(iii) Explain why it is important that a person's perception of a risk is close to the actual risk.

(3)

this very important because they don't underestimate the danger the people

It's so important for people's perception of risk to be close to the actual risk because this shows that they do not underestimate the danger. If they are alert of the risk, then they might start taking specific drugs to prevent a CVD or start following a better diet (low salt intake low cholesterol level) or even better start regular exercise.

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Examiner Comments

This is another example of a response providing an explanation of two aspects. It was awarded 2 marks for marking 2 and then marking point 1.

Question 6 (b)(i)

This mathematical question required candidates to identify relevant values from the first table, do a very simple calculation and then use the calculated value in the second table.

(i) Calculate the 10-year risk of CVD for a 35-year-old woman who:

- has a total cholesterol level of 242 mg dm^{-3}
- is a smoker
- has a systolic blood pressure of 132 mm Hg.

(2)

total points = -3 + 11 + 9 + 2 = 19

∴ risk = 8 %

Answer 8 %

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Examiner Comments

This is an example of a response that was awarded the full 2 marks.

Question 6 (b)(ii)

Candidates tended to have good knowledge of the factors that cause CVD. However, in this question candidates lost marks by either not explaining their answers or not referring to the table to guide them on the focus that their answers should take.

(ii) Explain the lifestyle changes this woman could make to reduce her 10-year risk of CVD.

Use the information in the table to support your answer.

(2)

The woman could reduce her fat intake, and consume to reduce cholesterol less salt to reduce blood pressure.

Stop or reduce smoking to reduce damage to endothelial lining of blood vessels.

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Examiner Comments

This is an example of a good response. The candidate has studied the table and identified the three aspects of lifestyle that the answer should include. However, the candidate has explained two out of the three changes.

ResultsPlus
Examiner Tip

Questions that include, 'use the information in the table (or graph, or diagram) to support your answer', require candidates to either manipulate the information given or to use it as a guide to what needs to be included in the answer.

Question 6 (b)(iv)

As in previous questions in Q6, candidates lost marks by not recognising that their suggestions had to relate to the study described in the question.

(iv) Suggest why this method of determining the 10-year risk of CVD may not be accurate.

(2)

This method doesn't include all the risk factors CVD such as level of ^physical activity ~~(physical)~~ or diabetes which are risk factors for CVD. This method doesn't include details on smoking such as number of cigarettes per day, which could have an effect on the level of risk.

ResultsPlus
Examiner Comments

This is an example of a good response. The candidate has clearly studied the details of the study described in the question and linked it to their answer. The response was awarded the full 2 marks.

ResultsPlus
Examiner Tip

Read the question carefully and relate your answer to the context of the question, if that is what you have been asked to do.

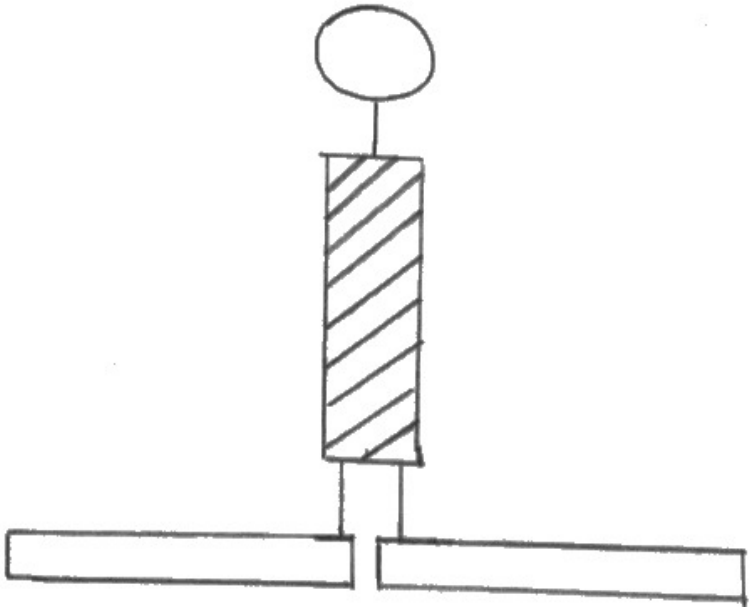
Question 7 (a)(i)

In previous series, candidates have been required to write a description of a phospholipids and draw DNA molecules from shapes given to them in the question. In this question, it is the first time that candidates have been required to combine the two in their answer.

Drawing a diagram may seem an easy way to gain marks. However, a diagram has to accurately represent the real thing and quite often needs to be drawn with care.

(i) Draw a diagram of a phospholipid, using the information in the table.

(2)

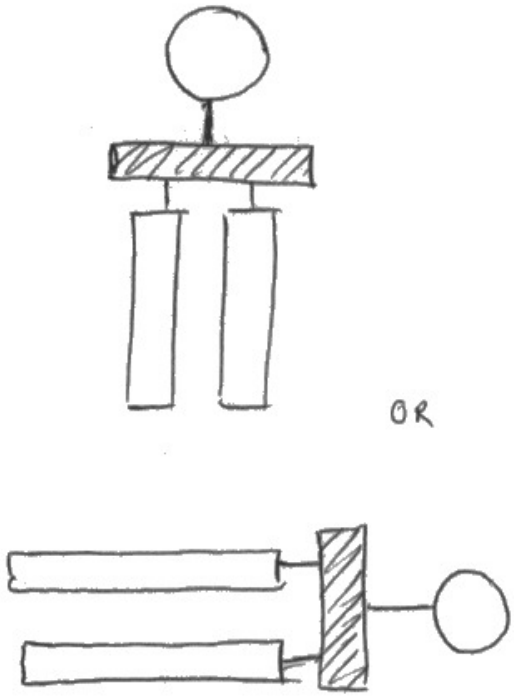


ResultsPlus
Examiner Comments

Provided the correct shapes were used and correctly bonded together, candidates did not lose marks on how the rectangles for the glycerol and fatty acids were orientated. This response was awarded the full two marks.

(i) Draw a diagram of a phospholipid, using the information in the table.

(2)



ResultsPlus
Examiner Comments

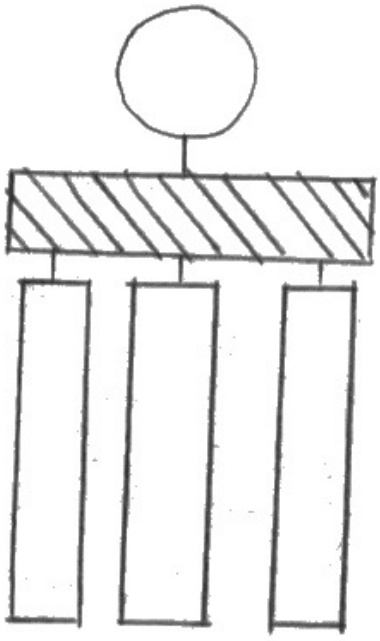
This candidate chose to draw two slightly different diagrams which were both correct. This response was awarded the full 2 marks. In these circumstances, examiners are required to mark the first answer given. Had the first one been incorrect, this response would have been awarded no marks.

ResultsPlus
Examiner Tip

Avoid 'hedging your bets' as you could gain zero for a response.

(i) Draw a diagram of a phospholipid, using the information in the table.

(2)

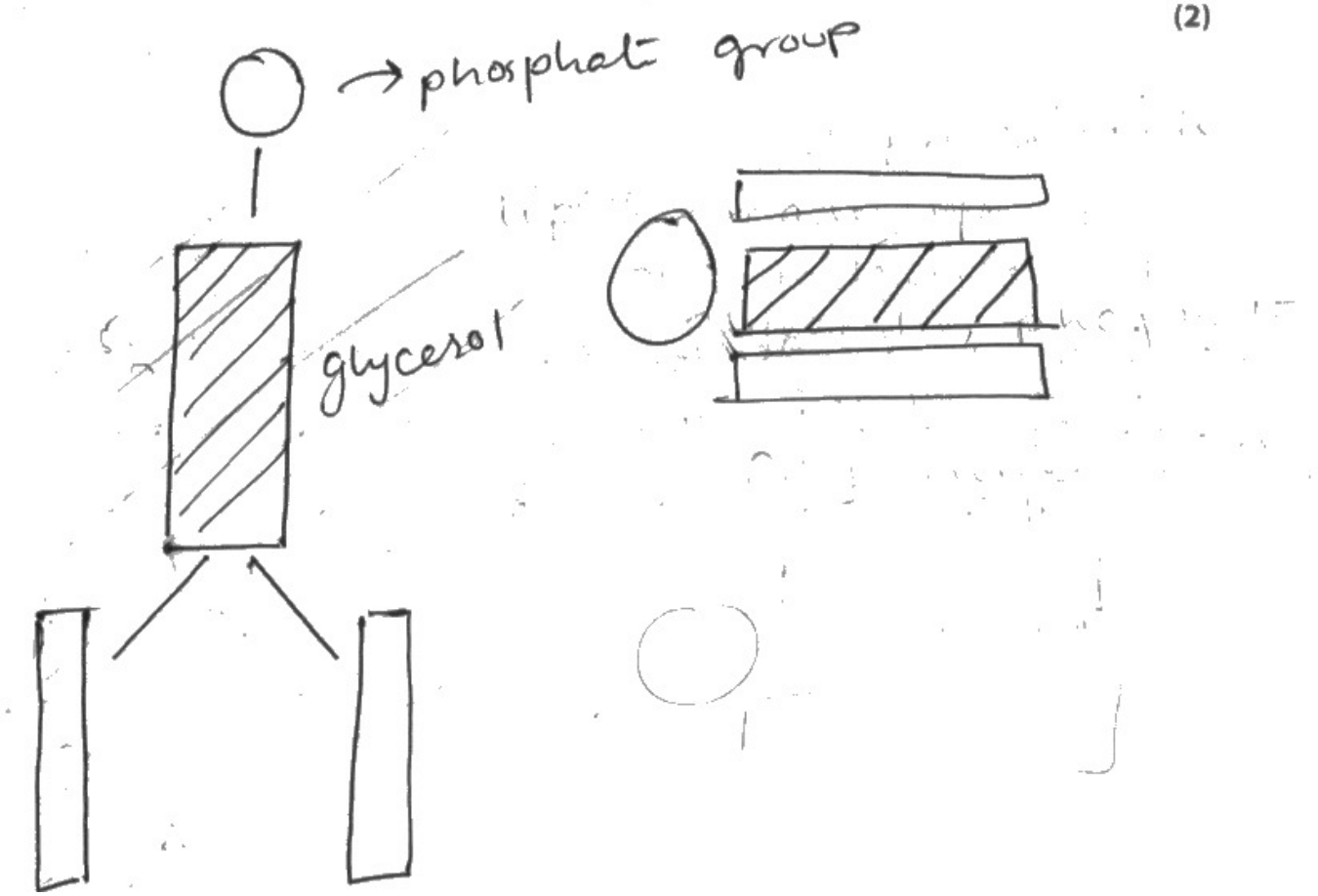


ResultsPlus
Examiner Comments

This is an example of a common error. The mark scheme allowed for a consequential error if the molecule was drawn correctly, other than the extra fatty acid and covalent bond.

(i) Draw a diagram of a phospholipid, using the information in the table.

(2)



ResultsPlus
Examiner Comments

Covalent bonds attach components together by joining to each component, linking them together. In this diagram none of the covalent bonds are touching any of the components and it was only awarded 1 mark.

Question 7 (b)(i)

Candidates are generally good at linking an increase in temperature with an increase in (heat / kinetic) energy. In previous series, candidates have been given questions about the movement of phospholipids and it was good to see an improvement in their response in this series that did not refer to the bilayer moving, which had been a frequent error in the past.

(b) The fluidity of a membrane is increased by a number of factors:

- increase in temperature
- increase in the proportion of unsaturated fatty acids
- decrease in cholesterol
- fatty acids with shorter side chains.

(i) Explain why an increase in temperature increases the fluidity of the membrane.

(2)

A) the temperature increases, molecules gain more kinetic energy and vibrate faster. Therefore the phospholipids in the bilayer can move around more and there will be more gaps between the phospholipids.

ResultsPlus
Examiner Comments

This is an example of a fairly typical response. A number of candidates wrote about the extra spaces that would be created. However, the mark scheme stated that there would not actually be spaces as the phospholipids would just move to fill in the gaps. Candidates were not penalised for this. This response was awarded the full 2 marks.

Question 7 (b)(iii)

This question proved most challenging for candidates. The majority of candidates were less confident on the interactions of cholesterol and its role in the cell membrane. Few responses were awarded the full 2 marks.

(iii) Explain why a decrease in cholesterol increases the fluidity of the membrane.

(2)

when the cholesterol level decreases, less cholesterol will bind to the non polar fatty acids tails in the phospholipid. so the movement of phospholipids is ~~less~~ restricted less. so the phospholipids can move around. Therefore fluidity increases.

ResultsPlus
Examiner Comments

This is an example of a response that was awarded the full 2 marks.

Question 7 (b)(iv)

In this question, candidates were require to consider the effects of having different length fatty acids in a phospholipid Overall, candidates performed well on this question and there were very few blank responses.

(iv) Suggest why a fatty acid with a shorter side chain will increase the fluidity of a membrane.

(1)

fatty acid tail are non-polar and hydrophobic · less fatty acid means less binding with cholesterol, so increased fluidity

ResultsPlus
Examiner Comments

There were two alternative suggestions in the mark scheme for this question. This is an example of the most common response to the question which was awarded the 1 mark.

ResultsPlus
Examiner Tip

In this question, the command word 'suggest' requires candidates to infer a meaning to the context of the question. Candidates are able to gain marks by the relevance of their response to the question rather than meeting a specific marking criteria. Therefore, it is better for candidates to write something than leave the answer blank.

Question 7 (c)(i)

This was another question with the command word 'suggest'. The majority of candidates responded very well to this question. Candidates were able to refer to the bullet points in Q7b to help answer this question.

(c) Studies have shown that when fish are moved into water at a lower temperature, the fatty acid content of their membranes changes.

(i) Suggest how the content of the fatty acids in these membranes may have changed.

(2)

There may become more unsaturated fatty acids and more fatty acids with shorter side chains in order to increase the fluidity of the membrane

ResultsPlus
Examiner Comments

This is an example of a good response that illustrates both marking points. It was awarded the full 2 marks.

Question 7 (c)(ii)

Most candidates found this question challenging and it was a good differentiator.

(ii) Suggest why these changes are necessary for the survival of the fish.

(2)

lower Temperatures mean That The fluidity of the membranes decreases, meaning That by getting shorter fatty acid side chains The fluidity would once again increase

ResultsPlus Examiner Comments

This candidate gained a mark for the first marking point. However, as the answer did not extend to explain why maintaining fluidity is important no further marks were awarded.

ResultsPlus Examiner Tip

Try to identify the specification point on which you are being tested. In this question, the clue is 'fluidity' so think back to your lessons on the role of the cell membrane and topics where a change in shape of the membrane has been involved.

(ii) Suggest why these changes are necessary for the survival of the fish.

(2)

lower temperature leads to less fluidity, more phospholipids would decrease permeability of the membrane, so less fatty acids will result in less phospholipids to allow the bilayer to be permeable enough to let substances diffuse through it.

Lower temperature leads to less fluidity, so more cholesterol is produced to keep the fish warm and maintain fluidity between phospholipids.

ResultsPlus
Examiner Comments

It is a shame that this candidate did not continue with their original idea. We saw a lot of answers talking about keeping the fish warm. This response was awarded 1 mark.

Question 8 (a)

In previous series, candidates have found expressing ratios quite challenging but there was a noticeable improvement in this series.

8 Mutations can give rise to cancer or genetic disorders.

(a) Cancer is one of the main causes of death in the world.

In 2018, in the UK, there were 541 589 deaths in total and 166 800 of these were due to cancer.

Calculate the ratio of deaths caused by cancer to deaths not caused by cancer.

Give your answer to two decimal places.

(2)

not cancer : cancer

374789 : 166800

166800 166800

2.2469.. : 1

~~1.25~~

1 : 2.25 ratio

Answer 1 : 2.25 ratio

ResultsPlus
Examiner Comments

This is an example of a response that was awarded the full 2 marks.

Ideally, the ratio should be expressed as [something] : 1. However, as in previous series, the mark scheme allows for both alternatives.

8 Mutations can give rise to cancer or genetic disorders.

(a) Cancer is one of the main causes of death in the world.

In 2018, in the UK, there were 541 589 deaths in total and 166 800 of these were due to cancer.

Calculate the ratio of deaths caused by cancer to deaths not caused by cancer.

Give your answer to two decimal places.

(2)

541 589 − 166 800
= 374 789

0·45
2·25

Answer 0·45 : 2·25

ResultsPlus
Examiner Comments

This is an example of a response that was awarded 1 mark.

A ratio must have one value given as a 1, ideally the second value.

ResultsPlus
Examiner Tip

Check the maths appendix in the specification for a list of maths skills that you should be covered in this qualification.

Question 8 (b)(i)

The majority of candidates were successful on this question provided that they gave the specification names for the mutations.

(i) Name **two** other types of mutation.

(1)

1 Elimination

2 Addition

ResultsPlus
Examiner Comments

This is an example of a response that was awarded zero marks. 'Elimination' and 'addition' describes the mutation. However the terms used in the specification are 'deletion' and 'insertion'.

Question 8 (b)(ii)

In this question, the command was 'estimate' which allowed candidates to consider a large range of values for the percentage.

(ii) Estimate the percentage of cancers caused by type 3 substitution mutations.

(1)

50 + 12.5 = 62.5%

25 ÷ 2 = 12.5

Answer 62.5 %

ResultsPlus
Examiner Comments

Examiners were instructed that estimates could only be to one decimal place. Therefore, this is an example of a response that was awarded the 1 mark.

ResultsPlus
Examiner Tip

Consider the question when deciding on the number of decimal places to give in your answer, if you have not been given a specific instruction. Making an estimation from this chart is going to be very approximate and cannot be made to one decimal place of accuracy.

Question 8 (b)(iii)

This question required candidates to comment on the DNA, mRNA and the protein. Many candidates tended to focus on the DNA and the degenerate nature of the genetic code without commenting on the mRNA or the protein. One common error was that some candidates were not referring to the genetic code being degenerate. For example, they were calling the DNA or the bases, or the base sequence, degenerate.

(iii) A type 1 substitution mutation in a gene alters the DNA and mRNA but does **not** affect the protein synthesised from the mutated gene.

Explain how a substitution mutation can alter the DNA and mRNA but **not** the protein.

(4)

A substitution mutation occurs when a base in the DNA sequence is replaced by another. This would alter the DNA, and the mRNA because there would be a different complementary base on the mRNA strand, but would not affect the protein synthesised if the new codon still codes for the same amino acid; This is due to the degenerate nature of the genetic code.

ResultsPlus
Examiner Comments

This is an example of a very well-written response by a candidate who had identified the three aspects that needed to be covered in the answer. The only marking point that was not awarded was the last marking point as the response was too vague about the absence of an effect on the protein.

ResultsPlus
Examiner Tip

Read the question and ask yourself why it is worded it in a particular way. DNA, mRNA and protein would not have been listed if there were no requirement for you to comment on each of them.

Question 8 (c)(ii)

The final question on the paper was a levels-based question based on a pedigree diagram. A wide range of responses were seen with very few candidates deterred by the fact that we used PKU as the genetic disorder and not the more familiar cystic fibrosis. There were a few candidates who tried to answer the question as though the condition was sex-linked and there were a few who ignored the pedigree diagram in the question and wrote a more generic description.

To be awarded full marks on a levels-based question, the answer has to cover all aspects of the question. This sounds like a challenge but it is only necessary to write a little about a lot, and not a lot about a little. Candidates who can write succinctly can score full marks in six or seven sentences. The approach is to identify the aspects that need to be covered before launching into writing the answer.

*(ii) Discuss the extent to which this pedigree diagram can be used to identify the genotypes of all the members of this family.

(6)

The genotype of person 1 & 2 can be assumed as heterozygous for the recessive PKU gene, as they are unaffected but have affected offspring. Individual 3 & 4 are homozygous for the recessive gene as they express the gene. Individual 5 is more ambiguous, as there is a 50% chance they are a carrier & 25% chance they are homozygous dominant — as they are not homozygous recessive, they have a $\frac{1}{3}$ chance of being homozygous dominant and a $\frac{2}{3}$ chance of being heterozygous recessive. If heterozygous recessive, individual 6 is most likely homozygous dominant & not a carrier as none of their offspring, (individuals) 7 & 8 & 9, have been affected by PKU (homozygous recessive) & there's a 25% chance of being homozygous recessive for the gene if both parents are carriers. Therefore, individuals 7 & 8 & 9 would have a 50% chance of being homozygous dominant (not being carriers) & a 50% chance of being heterozygous (asymptomatic carriers). If individual 5, however, was homozygous dominant, the individual 6 could be either homozygous dominant or heterozygous for the gene, as the same statistics apply. The pedigree tree can be used to estimate an identification for individuals 1, 2, 3, & 4 easily, but with individuals 5, 6, 7, 8 & 9 it becomes more difficult especially as individual 6's parents & siblings are unknown/unshown in the pedigree diagram.

ResultsPlus
Examiner Comments

This is an example of a response which clearly demonstrates what is expected of the question to gain the full 6 marks. The candidate has methodically discussed each group of people stating their genotypes, or possible genotypes, and explained how they came to these conclusions. The candidate has also made a clear discussion about the uncertainty of some of the individual's genotypes, which is expected for a level three response.

ResultsPlus
Examiner Tip

On this question, there are nine individuals shown in the diagram so this would suggest each individual needs their genotype identified and a reason given. A maximum of nine short sentences is expected, but as individuals 1 and 2 and individuals 3 and 4 have identical genotypes these can be rolled together giving seven sentences. The command word at the beginning of the question is 'discuss' which suggests that there may be more than one alternative for some individuals, so this would need commenting on.

*(ii) Discuss the extent to which this pedigree diagram can be used to identify the genotypes of all the members of this family.

(6)

The pedigree diagram can be used to determine the genotypes of individuals 1, 2, 3 and 4. The genetic is caused by a recessive allele as individuals 1 and 2 who are unaffected have affected offspring thus as 1 and 2 have effected offspring but are unaffected they have a heterozygous genotype of Pp as the dominant allele is expressed allowing them to remain unaffected. The individuals 3 and 4 have genotype pp of homozygous recessive as they are affected by PKU which is only express if both alleles are recessive as it is a recessive allele (recessive allele caused by mutation). Individual 5 may be homozygous dominant or heterozygous (PP or Pp) as they are unaffected although the genotype cannot be determined precisely as the offspring of individual 5 are all unaffected. Individual 6 may also be homozygous dominant or heterozygous as although as the offspring are all unaffected it is likely that either 5 or 6 are homozygous dominant. All offspring of 5 and 6 are unaffected thus are either homozygous dominant or recessive, although if 5 and 6 are both homozygous dominant offspring will all be homozygous dominant. Individuals 5, 6, 7, 8 and 9 are either PP or Pp.

ResultsPlus
Examiner Comments

This is another example of a response that covered all aspects of the question and was awarded the full 6 marks.

*(ii) Discuss the extent to which this pedigree diagram can be used to identify the genotypes of all the members of this family.

(6)

This Pedigree diagram can identify females that are affected with PKU, males that are affected with PKU as well as the males and females that are unaffected with PKU. It can also identify whether the couple's children would be affected with PKU or not.

ResultsPlus
Examiner Comments

This is a response that was awarded 1 mark. The candidate has not realised that the answer should contain specifics relating to this genetic diagram. The candidate has described what a pedigree diagram is and what it can show.

*(ii) Discuss the extent to which this pedigree diagram can be used to identify the genotypes of all the members of this family.

(6)

pedigree diagram shows the members of the family using the key, the diagram shows which numbers of the family are affected by p ku and which members are not affected, The affected members are represented by filling in the shapes. C only 2 males are affected) The pedigree diagram also distinguishes between males and females using different shapes. Females have a circular shape and males have a square shape. Individuals who are carriers are represented in a pedigree diagram by coloring half the shape but it's not shown in the given diagram so the diagram lacks that step to show who in family are carriers.

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Examiner Comments

This candidate has taken a similar approach, describing in general terms what a pedigree diagram shows.

Paper Summary

Overall the paper worked as intended and some very good, clearly presented answers were seen.

Centres are clearly using past paper mark schemes to prepare their candidates and are taking on the comments that were made in previous Principal Examiners' reports. The following points have been made in previous reports but still apply.

- Candidates need to read the question carefully to identify the command word and the various aspects that they need to cover in their answer. The specification for this qualification provides a list of the command words and the expectation on using them in a response.
- Greater emphasis should be placed on the skills candidates need to tackle the mathematic elements on this paper. The specification for this qualification provides an appendix of the mathematical elements that candidates should cover in preparation of the exam.
- Careful consideration of the number of decimal places or significant figures is necessary if the question does not specify. If the question does specify then the instruction must be followed for full marks to be accessed.
- Workings to calculations should be shown.
- The marks allocated to a question should be taken into consideration to determine how much to write.
- Levels-based responses should cover all aspects of the question and not focus on one small component.
- Diagrams should be drawn accurately to represent exactly what is being drawn.
- All questions should be attempted.

Grade boundaries

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