



# **Examiners' Report June 2022**

**International GCSE Human Biology 4HB1 01**

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## Introduction

This paper elicited a wide range of responses providing opportunities for candidates to demonstrate their knowledge and understanding of Human Biology.

The paper consists of a mixture of different question styles, including multiple-choice questions, short-answer questions, calculations and extended open-response questions. Candidates may use a calculator in the exam for the mathematical calculation questions.

It was noted by examiners that, as in previous series, candidates find the mathematical calculation questions challenging.

## Question 1 (a)(iii)

In this question, candidates were given a diagram that showed part of a molecule of DNA and they were asked to describe how the two backbones of the DNA molecule are joined together. Some of the weaker response failed to mention complementary base pairing or omitted the term 'base'.

## Question 1 (b)(i)

This is a comparison question and candidates were required to give two differences between the structures of DNA and RNA. The majority of candidates coped well with this question. However, some weaker responses gave just one side of the answer, eg, DNA has thymine. Some candidate responses lacked clarity in expression.

(b) DNA is a nucleic acid.

RNA is another type of nucleic acid.

(i) Give two differences between the structures of DNA and RNA.

(2)

- 1 DNA is double stranded whereas RNA is single stranded
- 2 DNA contains deoxyribose whereas RNA contains just ribose



**ResultsPlus**  
Examiner Comments

This is a response that was awarded the full 2 marks. This is a good, clear answer giving precise comparisons.



**ResultsPlus**  
Examiner Tip

Always refer to both sides, in this case DNA and RNA.

Short sentences that are clear will score the marks.

(b) DNA is a nucleic acid.

RNA is another type of nucleic acid.

(i) Give two differences between the structures of DNA and RNA.

(2)

- 1 DNA is double helix but RNA is single strand
- 2 DNA is de-oxiribose nucleic acid but RNA is Ribonucleic acid.



**ResultsPlus**  
Examiner Comments

This is a response that was awarded 1 mark. The candidate should have referred to two strands rather than helix but double helix was allowed. Single helix was not allowed. The second response repeats what is in the question.



**ResultsPlus**  
Examiner Tip

Always make sure that both structures are mentioned in a response.

## Question 2 (a)(i)

In this question, candidates were given a graph which showed how a person's heart rate changes with exercise. Candidates were asked to determine the difference between the maximum heart rate and the resting heart rate.

This question required candidates to carry out a straightforward calculation. However, many candidates did not set out the full workings or they read the figures incorrectly.

### Question 3 (a)(i)

In this question, candidates were required to describe how the equipment shown in the diagrams could be used to investigate the energy content of different foods.

The majority of candidates answered this question well. Common omissions were to not take the initial and final temperatures. Very few candidates mentioned a clamp and stand to hold the test tube.

(i) Describe how the equipment can be used to investigate the energy content of different foods.

(5)

- Take different sample of food of the same mass by using digital scale
- Measure  $30\text{ cm}^3$  of water using measuring cylinder. Pour the water in the test tube
- Measure ~~int~~ the initial and final temperatures of water of each different food content using thermometer
- Place sample on mounted needle, burn sample using bunsen burner.
- Burn the samples ~~from~~ at the same distance from test tube
- Record results in table
- The higher the difference of temperature, the higher the energy content.



This is a good, clear, concise answer which was awarded the full 5 marks. The candidate has referred to the mass of the food being determined prior to it being burnt. The answer also refers to a suitable volume of water to be poured into the test tube. Many answers used volumes that were far too great, though the candidate was not penalised for doing so on this occasion.



Always read through your answer at the end to ensure that what has been stated is feasible.



- (i) Describe how the equipment can be used to investigate the energy content of different foods.

(5)

Take a dry food sample (dried beans), insert it into the mounted needle. Put a fixed volume of water into the measuring cylinder. Calculate the temperature of the water and record. Light up the food and immediately put under the test tube. But before doing that, transfer the water from the measuring cylinder to the test tube. Allow the food to burn under the test tube heating (transferring energy to the water test tube). Continue burning the food sample until it can no longer burn or light or catch fire. Then check the temperature of the water again.



This is a response that was awarded 4 of the 5 marks available. The candidate refers to 'calculating the temperature' rather than measuring with the thermometer. There is a lack of clarity of where the water goes and a clear statement on putting it into the test tube is required at the beginning.



Clear sentences are always required with this type of 'describe' question.

(i) Describe how the equipment can be used to investigate the energy content of different foods.

(5)

Measuring cylinder helps to measure how much water you need in the ~~for~~ investigation. You need to make sure that you <sup>are</sup> using the same amount of water in each food testing.

Thermometer is used to check the temperature of the water. The same temperature for each food. Also, how much higher the temperature gets off burning/~~so~~ heating up the food. Test tube is used to put the food in whiles you are cooking/burning up the food. It safer then holding it with tongs.

Mounted needle is to pick up the food. It's instead of using your hands <sup>so you don't</sup> ~~and~~ adding anything to the food. Also if the test tube is hot then you don't want to touch something hot.



This is an example of a response that was awarded zero marks. The candidate has written an account of the apparatus but has not given a description as to how to conduct the investigation.



Candidates need to have experience of performing these experiments. Each step in the process should be given in a logical order.

### Question 3 (a)(ii)

In this question, candidates had to name two variables that needed to be controlled in the investigation. A common error in this question was the use of the word 'amount' which is far too vague and does not give the necessary precision.

(ii) Name two variables that need to be controlled in the investigation.

(2)

1. Some mass of food.

2. Same distance between burning food and test tube.



**ResultsPlus**  
Examiner Comments

This answer is clear and precise and it was awarded the full 2 marks.



**ResultsPlus**  
Examiner Tip

Always refer to mass/volume and not amount.

(ii) Name two variables that need to be controlled in the investigation.

(2)

1 The amount of water in the test tube

2 The amount of the food sample.



This is an example of a response that was awarded zero marks. The use of the word 'amount' is not acceptable.



Use the term 'volume' for a liquid and 'mass' for a weight.

(ii) Name two variables that need to be controlled in the investigation.

(2)

1 Volume of water in test tube.

2 Initial temperature of water.



This is a response that was awarded 1 mark. The initial temperature of the water is irrelevant.

### Question 3 (b)(iii)

(iii) Calculate the percentage difference in the energy requirement of males compared with females in the age range of 35–44 years.

(3)

percentage difference = 23 %



**ResultsPlus**  
Examiner Comments

This candidate has not shown any working and so there is no indication of how this answer is derived. As it is incorrect no marks can be awarded.



**ResultsPlus**  
Examiner Tip

Always include the working to a calculation.

(iii) Calculate the percentage difference in the energy requirement of males compared with females in the age range of 35–44 years.

(3)

$$2629 - 2103 = 526$$
$$\frac{526}{100} = 5.26$$

percentage difference = 5.26 %



**ResultsPlus**  
Examiner Comments

This candidate shows the working used in the calculation even though the final answer is incorrect. The first section is correct and so is awarded a mark.



**ResultsPlus**  
Examiner Tip

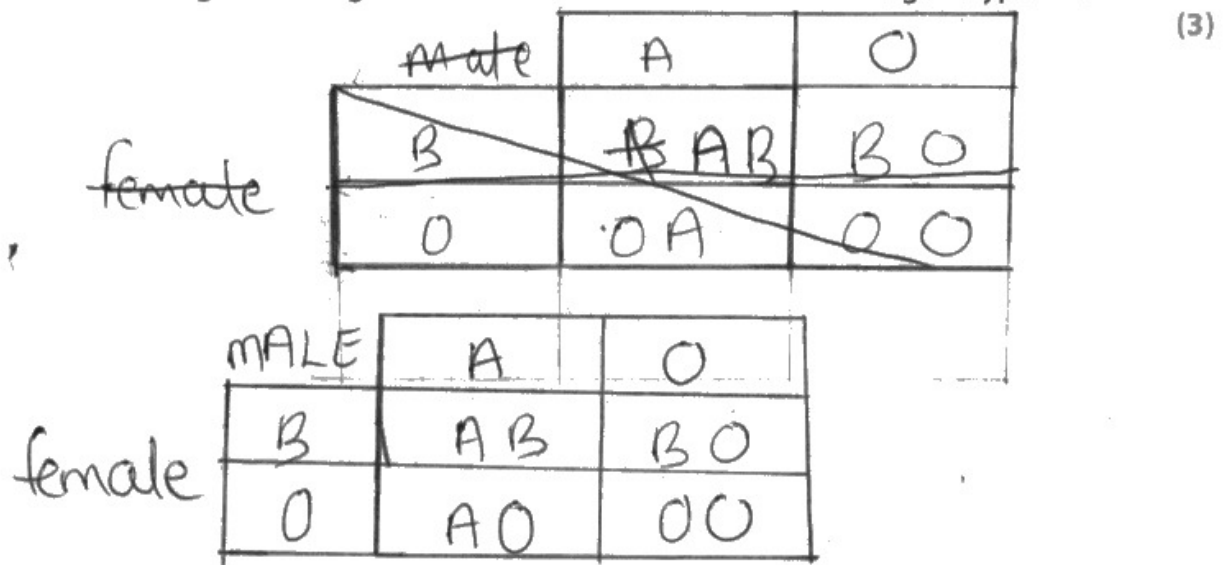
Always show working.

### Question 4 (a)(iii)

This was a question about blood groups and genotypes. Candidates were required to draw a genetic diagram to show how the child inherits the genotype  $I^O I^O$ .

(iii) A male with the genotype  $I^A I^O$  and a female with the genotype  $I^B I^O$  have a child with the genotype  $I^O I^O$ .

Draw a genetic diagram to show how the child inherits the genotype  $I^O I^O$ .



**ResultsPlus**  
Examiner Comments

This is an example of a common response that was awarded zero marks.



**ResultsPlus**  
Examiner Tip

Remember that the alleles for blood groups need to be represented with  $I^A/I^B$  etc.

When answering a question on genetics each stage should be written down namely, Parental Generation, gametes followed by the F1 generation. A mark is usually given for each of those stages so to omit one means that a mark cannot be awarded.



## Question 4 (b)

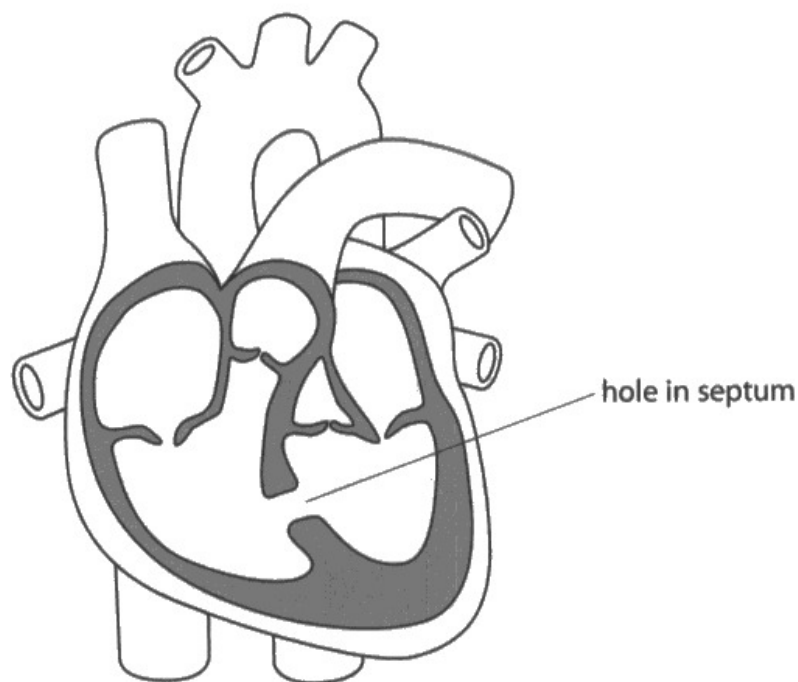
In this question, candidates were asked to explain why a person with a hole in their heart breathes at a greater rate than a person with a healthy heart. The common omission was a failure to mention that blood would pass through the hole from one side of the heart to the other.

(b) The heart pumps the blood around the body.

The diagram shows a human heart.

This heart has a hole in the septum.

This means that blood from the left side of the heart mixes with blood from the right side.



Explain why a person with a hole in their heart breathes at a greater rate than a person with a healthy heart.

(4)

A person with a whole in their heart breathes at a greater rate because the deoxygenated blood from the right side and the oxygenated blood from the left side mixes together this causes the blood to not flow as smoothly which makes it harder to breathe.





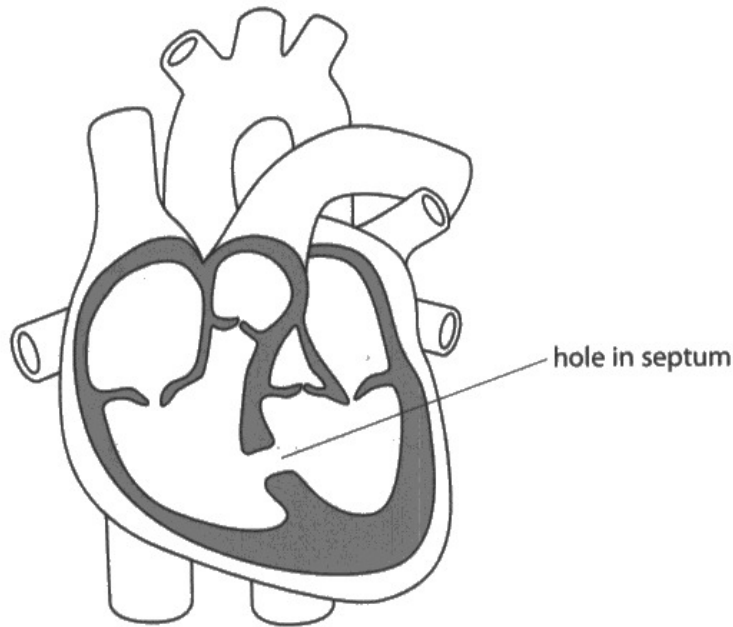
This is an example of a response lacking both clarity and detail and it was awarded 1 mark. The candidate has made some reference to the idea that oxygenated and deoxygenated blood will mix but there is no reference to the outcomes of this mixing or an explanation for the increased rate of breathing.

(b) The heart pumps the blood around the body.

The diagram shows a human heart.

This heart has a hole in the septum.

This means that blood from the left side of the heart mixes with blood from the right side.



Explain why a person with a hole in their heart breathes at a greater rate than a person with a healthy heart.

(4)

When there is a hole in the septum, deoxygenated blood and oxygenated blood mix. This means that less oxygen and oxygenated blood will be pumped to body cells, so less oxygen <sup>and times</sup> means a lower rate of aerobic respiration, so less energy in the form of ATP is released so less energy for growth and metabolic reactions. This also reduces steepness of concentration gradient between air in alveoli and blood in capillaries in the lungs so less oxygen diffuses down its concentration gradient from air in alveoli to blood as less <sup>Also there is less removal of carbon</sup> deoxygenated blood is pumped to lungs. (Total for Question 4 = 13 marks)

- dioxide from the blood, so blood pH ~~is~~ decreases, which is detected by chemoreceptors in aorta and carotid artery, so they send impulses along sensory neurones to ventilation centre in medulla oblongata, which sends more frequent impulses to respiratory muscles along motor neurones, stimulating intercostal <sup>14)</sup> muscles and diaphragm to contract more frequently ~~so~~ and strongly, so increasing breathing rate and depth to increase oxygen uptake by blood in lungs for more aerobic respiration.

P. 7 0 9 7 3 A 0 1 4 2 4



This is a response that was awarded 3 marks. The candidate has given a long answer extending beyond the lines provided in the paper. Whilst three of the relevant points are made there is much irrelevant detail included in the answer.



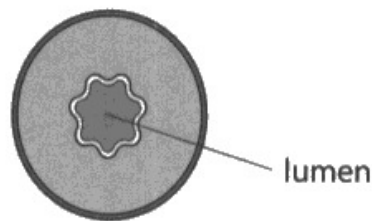
Remember that the number of lines provided for writing and the mark allocation for the question are an indication of the length of answer required.

## Question 5 (b)

In this question, candidates were given a diagram of a cross-section of a blood vessel in the skin on a cold day. Candidates were asked to explain the changes in the blood vessel on a hot day.

A common omission was a failure to refer to vasodilation. A common mistake made by candidates was to describe blood going to the surface of the skin or blood vessels moving nearer to the surface of the skin. Neither of these two scenarios were acceptable.

(b) The diagram shows a cross-section of a blood vessel in the skin on a cold day.



Explain the changes in this blood vessel on a hot day.

(3)

*your blood vessels on a hot day will be  
inflamed at your body will be trying to cool  
down, so your blood vessels and capillary  
will rise to the surface*

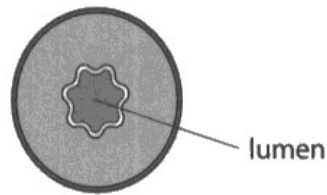


This is a response that was awarded zero marks. The candidate's response illustrates the common mistake of blood vessels rising to the surface or moving to the surface.



Candidates should be discussing the fact that, as a result of vasodilation, there is more blood flowing through the skin capillaries. This has no effect on their position, it just allows more heat to be carried in the skin capillaries with the potential to lose more heat via radiation.

(b) The diagram shows a cross-section of a blood vessel in the skin on a cold day.



Explain the changes in this blood vessel on a hot day.

(3)

~~A~~ Narrower lumen (smaller diameter)  
This is due to vasoconstriction to reduce amount of blood going in vessels near skin to reduce the heat lost by radiation from vessels near skin to bring back body ~~temp~~ temperature to normal level by negative feedback mechanism.



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Examiner Comments

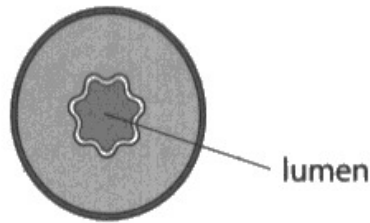
This is a response that was awarded 1 mark. The candidate has not read the question carefully. Although the candidate has reversed the explanation by describing what would happen on a cold day, a mark was awarded for a correct reference to radiation.



**ResultsPlus**  
Examiner Tip

Read the whole of the question and ensure that the answer applies to the question.

(b) The diagram shows a cross-section of a blood vessel in the skin on a cold day.



Explain the changes in this blood vessel on a hot day.

(3)

~~Arterioles vaso constrict, by relaxation (vasodilation) of smooth muscle so decreasing the blood~~  
Arterioles vasodilate (get wider), by constriction of smooth muscle ~~increasing~~ increasing the blood flow near the skin surface so that more heat can be lost by radiation or convection.



This is an excellent concise and correct answer which was awarded the full 3 marks. The candidate has clearly referred to vasodilation with a comment that more blood is flowing 'near' the surface of the skin, not on or at the surface which would be incorrect.



Focus your answers and avoid including any additional material that could cause confusion.



## Question 5 (c)

In this question, candidates were asked to describe how ADH regulates the volume of water in the body on a hot day.

The majority of candidates answered this question well. However, a common mistake was to refer to the secretion of ADH by the hypothalamus rather than the pituitary gland. A common omission was a failure to refer to increased permeability of the collecting duct or that water is reabsorbed into the blood.

(c) Describe how ADH regulates the volume of water in the body on a hot day.

(4)

On a hot day, body loses more water by sweating. Blood's water content decreases and this is detected by hypothalamus. Pituitary gland starts to secrete more ADH to blood. ADH makes the collecting duct walls more permeable so more water can be reabsorbed back into blood. This causes the blood's water content to go back to normal. Because more water is reabsorbed, the volume of urine is reduced and urine is more concentrated.



This is a response that was awarded the full 4 marks. The candidate has clearly described the points. The only criticism is that there is a fair amount of extraneous material that is not relevant to the question.



Focus the content of your answer to the question. For example, this answer gives details of urine concentration which is not asked for in the question.

(c) Describe how ADH regulates the volume of water in the body on a hot day.

(4)

In negative feedback, when the body detects that the body is too hot and losing too much water, it restricts the amount of water lost through urine as when the person is sweating, water is lost. This ensures that the water is kept at a consistent level for the body to function properly.



**ResultsPlus**  
Examiner Comments

This is an example of a response that was awarded zero marks. The candidate has made no reference to the role ADH but has instead discussed sweating.



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Examiner Tip

Read the question carefully and check that your answer relates specifically to what is being asked.



(c) Describe how ADH regulates the volume of water in the body on a hot day.

(4)

→ ADH - anti-diuretic hormone,

→ during hot day, the volume of water in blood is less, this is detected by baroreceptors, they send nerve impulses that the volume of blood is low to

hypothalamus, which sends nerve impulse to pituitary gland to <sup>(neurosecretory cells)</sup> release ADH into blood to the

kidney (target organ) so causes collecting duct

and distal convoluted tubule to become more permeable to water by ~~repacking aquaporins~~ <sup>causing aquaporins</sup> ~~to fuse with cell membrane,~~ <sup>back to vesicles</sup> causing more water channels,

so less water in collecting duct, urine concentration

blood volume increases; negative feedback

volume of water in body increases.

(Total for Question 5 = 11 marks)



**ResultsPlus**  
Examiner Comments

This is a response that was awarded 3 marks. The candidate has written a good response but there is a lot of irrelevant material that is not part of the specification namely, aquaporins. In addition, the candidate has not made a clear statement about more water being reabsorbed into the blood and so does not secure full marks.



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Examiner Tip

Ensure that your answers are precise and as concise as possible.

## Question 6

In this question, candidates were asked to describe how bacteria can be genetically modified to produce human insulin.

The majority of candidates were very successful on this question as the topic area was well understood. However, some of the weaker responses showed a lack of precision in language. In addition, references to cutting the gene that gives rise to insulin were often vague.

6 Describe how bacteria can be genetically modified to produce human insulin.

(6)

Bacteria's have plasmid which is easy to remove. It is also easy to use because it ~~is~~ has no moral, ethical issues. It can also reproduce quickly. The plasmid can be extracted, then the insulin hormone can be placed inside it, then it could reproduce and produce insulin which is vital for people whom suffer from diabetes.

This plasmid is extracted in the first place because we are able to put genetic codes inside it which allows us to control the bacteria or command it or give it instructions. Then the scientist design the gene which gets inserted back into the bacteria. And the gene is the one the produces insulin in this case.



This is a response that was awarded 1 mark. The candidate has not given an accurate description of the sequence of the process involved. A mark for removing the bacterial plasmid was awarded.



Learn the correct sequence of events for processes.

6 Describe how bacteria can be genetically modified to produce human insulin.

Restriction endonuclease <sup>used to cut</sup> ~~is used to cut~~ DNA molecule <sup>(6)</sup> containing insulin gene where it recognises series of bases for insulin. This leaves sticky ends. <sup>The same</sup> Restriction endonuclease <sup>is</sup> then used to chop open bacteria ~~plasmids~~ also leaving sticky ends. The DNA molecule and bacteria are mixed together using DNA ligase which joins the complementary sticky ends together forming recombinant DNA. This is then mixed with more bacteria in a fermenter (for warmth to grow more bacteria) and bacterial plasmids take up the insulin gene and grow and reproduce in the conditions of the fermenter - producing GM insulin.



This is a response that was awarded 4 marks. The candidate has made some valid points but the sentences lack precision and clarity of expression.



Re-read your answers to ensure they make sense and the sequence of events can be clearly followed.

6 Describe how bacteria can be genetically modified to produce human insulin.

(6)

- extract a bacterial Plasmid
- ~~But~~ extract Part from gene Produces insulin in healthy <sup>human</sup> organism
- ~~cut~~ Cut ~~part~~ of gene by restriction endonuclease enzyme
- Forming gene with sticky ends
- Cut Plasmid by ~~end~~ restriction endonuclease enzyme, forming sticky ends
- Join gene with Plasmid using ligase enzyme
- insert Plasmid back to Bacteria
- Gene will be expressed forming human insulin



**ResultsPlus**  
Examiner Comments

This is a good, clear, concise and precise response that was awarded the full 6 marks. The only criticism is that it is arranged as bullet points rather than a written account. However, all of the relevant points are made and the language is clear and precise. This response demonstrates that it is possible to score full marks by writing what is relevant rather than simply filling the space available.



**ResultsPlus**  
Examiner Tip

Aim for clarity and precision in your answers.



## Question 7 (a)(iii)

In this question, candidates are told that industrial processes can use immobilised enzymes and candidates were asked to describe how to prepare alginate beads.

The majority of candidates were very successful on this question as the topic area was well understood. The question was a general one about the formation of beads but many candidates chose to couch their answers in terms of how the enzymes could be incorporated into the beads, which was not a requirement of the question.

(iii) Describe how to prepare alginate beads.

(3)

Use sodium ~~chloride~~ alginate solution and add it  
to the enzyme used and stir and mix.  
~~then~~ then add calcium chloride to the mixture.  
This will form sodium chloride and  
alginate crystals containing the enzyme.



**ResultsPlus**  
Examiner Comments

This is a response that was awarded the full 3 marks. However, the candidate refers unnecessarily to the incorporation of the enzyme but all of the other relevant points are present, except for a final washing of the beads.



**ResultsPlus**  
Examiner Tip

Check your answer to ensure that it is addressing the requirements of the question.

(iii) Describe how to prepare alginate beads.

(3)

- Make a solution of the enzymes that should used.
- Drop ~~the~~ by pipette same <sup>Volume</sup> ~~of~~ of enzyme solution in different solution that makes the solution turn to beads.
- then after while remove the beads formed then wash them.



This is an example of a response that was awarded 1 mark. The candidate has focussed their response on an enzyme rather than bead formation. A mark was given for a correct reference to washing the beads, even though there was no detail in the answer as to how the beads were formed.

## Question 8

In this extended open-response question, candidates were asked to discuss the advantages and disadvantages of the use of embryonic and adult stem cells in medical research.

Overall, this question proved very challenging for candidates. Many responses showed an inability to distinguish what was relevant and irrelevant. In addition, there were inaccuracies in the clarity of expression and the appropriate sequencing of answers.

- 8 Discuss the advantages and disadvantages of the use of embryonic and adult stem cells in medical research.

(6)

embryonic stem cells

Embryonic stem cells are obtained from the developing embryo, they have the ability to differentiate into any type of specialised cell (yet remain undifferentiated themselves) and can be used to treat a wide variety of diseases e.g. Parkinson's disease (and even form nerve cells) unlike the adult stem cells. However, the usage of embryonic stem cells faces a lot of moral objections, and social and ethical issues i.e. questions regarding who owns the embryo and whether it is right to take stem cells from a "developing" embryo, there is also a lack of donors.

adult stem cells

adult stem cells are more commonly used than embryonic stem cells i.e. bone marrow transplants and can be used to treat different diseases i.e. leukemia etc. However, these cells are obtained from the lining of tissues such as the intestine, skin. However, these cells have lost the ability to differentiate into any type of specialised cells, so there's a limit to the diseases that can be treated, but an advantage is that medical evidence is present to support the success of stem cell therapy and usage of adult stem cells does not face moral issues.

12



This response was awarded 4 marks. The candidate has made relevant points about embryonic stem cells and the ability to differentiate, including their role in the treatment of Parkinson's disease. The candidate correctly discusses ethical issues. However, the limitations of the answer are when the candidate discusses adult stem cells. The obvious points are that they are taken from the person/patient and there is no issue of rejection as a result.



- 8 Discuss the advantages and disadvantages of the use of embryonic and adult stem cells in medical research.

(6)

embryonic stem cells

Advantages of use embryonic stem cells is that it can ~~divide~~ differentiate <sup>→ & divide</sup> into any type of cells ~~it~~ with no hybrid limits. <sup>→ can form any cell type & be used to harvest & grow organs.</sup> The disadvantages is that it's extracted from an embryo & an embryo could be a potential life & using it in researches may kill it & this will be a murder as embryo has right to live.

adult stem cells

The advantages of using adult stem cells is that it can be extracted from ~~the~~ any area ~~to~~ containing it without harming the patient so no ethical issues arise. Moreover, stem cells can be used to grow & harvest an organ to be used in organ transplant for people who are in need of organs & solve the shortage of donors problem. ~~But~~ However, a disadvantage of adult stem cells is that they can divide into limited types of cell so not all types of organs can be obtained or harvested.



This response was awarded 3 marks. The candidate has covered some of the points but there is a considerable amount of detail that is lacking.



Ensure full details are given in open-response answers rather than just 'padding'.

## Question 9 (a)

In this question, candidates were given statistics about high blood pressure among men and women. Candidates were asked to explain how medication can be used to treat people with high blood pressure.

Whilst many candidates knew that ACE inhibitors or beta blockers were involved, there were many who discussed statins and also discussed the effect of cholesterol on blood pressure.

Candidates often failed to score full marks because they were unclear as to how the medicines acted and they were often very vague in their responses.

9 In England, 31% of men and 26% of women have high blood pressure.

(a) Explain how medication can be used to treat people with high blood pressure.

(4)

ACE inhibitors are used to decrease blood pressure as they stop the process of which angiotensin I turns into angiotensin II by the ACE enzyme. Angiotensin I causes the narrowing of blood vessels / vasoconstriction so the decrease in its secretion / production ~~it~~ increases the lumen diameter / decreases blood pressure as the narrower / ~~more~~ vasoconstricted the lumen is the higher the blood pressure. Lower blood pressure means treated hypertension / normal blood pressure decreasing complication risks of hypertension.



This is a response that was awarded the full 4 marks. The candidate described what angiotensin normally do, ie, constrict the arterioles. However, the question required candidates to know that arterioles would not be constricted thereby preventing an increase in blood pressure. The candidate does eventually make the point but not before a description of arteriole contraction is included.



Ensure that the information you give is answering the question.

9 In England, 31% of men and 26% of women have high blood pressure.

(a) Explain how medication can be used to treat people with high blood pressure.

(4)

- use anti-hypertensive drugs
- use Statins to decrease Cholesterol level in blood
- use Beta blockers to reduce the heart rate
- Avoid Consuming too much animal fats
- Avoid Smoking



**ResultsPlus**  
Examiner Comments

This is a response that was awarded 2 marks. The candidate has listed their knowledge about circulatory issues. This approach has yielded a couple of marks with reference to beta blockers and the slowing of the heart rate. However, the candidate has made some irrelevant points about avoiding smoking and consuming too much animal fat.



**ResultsPlus**  
Examiner Tip

Re-read the question carefully to ensure that the information you give is answering the question.

## Paper Summary

Candidates should take particular note of the following points.

- Ensure that the workings for all calculations are shown.
- Show workings in a logical sequence.
- Always write in clear, full sentences.
- Focus answers on the question asked and avoid writing down everything known about a topic.
- Ensure that when a question asks what happens if a substance is missing, avoid only stating what that substance does.

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