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Examiners' Report
June 2023

GCSE Biology 1BI0 1H

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Introduction

The Pearson Edexcel GCSE (9-1) Paper 1: Biology (Higher tier) paper is the first of two papers taken as part of the GCSE (9-1) Biology qualification. This is the sixth assessment of the GCSE (9-1) specification, although it was not examined in Summer 2020 and 2021. There were autumn sittings in 2020 and 2021 but these had much lower entries. In 2022 to compensate for lost learning as a result of the Covid pandemic, candidates had access to an advanced information document for this paper which detailed some of the content that would be included in the exam and some that was not included. Candidates this year did not have this advanced information and so had to prepare for questions from all the topics of the specification included in this paper.

The Biology specification and the qualification follows a linear assessment model whereby candidates must complete the two papers, worth 100 marks each, in the same single year of certification. Paper 1: Biology (Higher tier) is assessed by a variety of question types, including multiple-choice questions, short-answer questions, calculations and extended open-response questions. Candidates should answer all questions in a time period of 1 hour and 45 minutes. The extended open-response questions are identified by an asterisk (*) in the question paper to indicate that marks are also awarded for the ability to structure a response logically. There are two such questions in this paper. In addition, the GCSE (9-1) Biology qualification assesses practical knowledge and maths skills; the requirements of which are given in the specification. Furthermore, there are 8 mandatory core practicals which candidates must complete prior to the examination, as aspects of working scientifically are also assessed in questions throughout the paper. Paper 1: Biology (Higher tier) contains questions assessing the content from Topics 1 to 5, as identified in the specification.

In this examination series, candidates were required to respond to questions that tested their knowledge and understanding of the role of mitosis in asexual reproduction, defects of the eye including cataracts and short-sightedness, the role of stem cells in growth and medicine, the role of natural selection, plants disease distribution, translation, non-communicable diseases with reference to BMI and waist : hip ratio, reflex arcs, genetic inheritance and pregnancy testing. Questions designed to assess practical skills included measuring energy content though calorimetry including the use of equipment and a comparison of different apparatus, writing a plan to determine the effect of pH on the rate of reaction of amylase and the effect of salt concentrations on the movement of water by osmosis in potatoes, this included questions on accuracy and improving an investigation. The maths skills assessed in this paper related to calculations on energy values of foods, applying the idea of doubling to calculate a population size in bacteria, calculating magnification as well as using percentages and calculating a percentage increase.

There are now five past papers with mark schemes and examiners reports as well as sample assessment material, a year 10 mock and practical support booklets available for this qualification and it is clear that these resources are being utilised as part of the revision process. The use of scientific terminology in responses has improved, particularly in higher ability candidates. Most candidates were able to access both extended writing responses, although answers for the reflex arc were presented with a better structure and more specific detail. The distribution of plant diseases assessed a higher specification point that had not previously been assessed and it was clear which candidates had covered and understood the content well.

Most candidates showed good knowledge on defects of the eye and had a good understanding of the use of stem cells. Natural selection is a core concept but on this paper candidates had to apply their understanding of the process to extinction and this was something that candidates of all ability managed to show. This question linked to determining sex in birds through inheritance of chromosomes and again this application was something that candidates of all abilities achieved. Most candidates showed a good knowledge of the process of osmosis although they found the link to practical aspects of accuracy and improvements of methods more challenging. Candidates were provided with data and guidance related to BMI, waist : hip ratio, alcohol and smoking and all candidates were able to analyse the data and present conclusions, with higher ability candidates including detailed evaluations of the data. Candidates were assessed on their knowledge of enzymes through both theory and practical aspects. The method was based on the core practical and it showed that many candidates had done this practical, or slight variations of the method and had a good understanding of the techniques involved. Across the paper there was a general improvement in answering practical and maths questions, possibly reflecting teachers increased awareness of its importance.

The paper included a number of questions targeting specific higher specification points which are topics that candidates tend to find more challenging. These included the protein synthesis with reference to transcription and translation, sex-linked inheritance and pregnancy testing using monoclonal antibodies. These questions showed more differentiation across the candidates entered for the paper, with higher ability candidates showing a better understanding of these difficult concepts.

Question 1 (a)(i)

This question asked how a temperature rise could be calculated using a bomb calorimeter. The marks were awarded for using a thermometer and for measuring the start and end temperatures. Most candidates gained the second marking point but some did not mention the thermometer. Some responses used the thermometer to measure the temperature rise which repeats aspects from the question and so could only be awarded one mark for the thermometer.

1 A bomb calorimeter is used to measure the energy content of a food sample.

Figure 1 shows a bomb calorimeter.

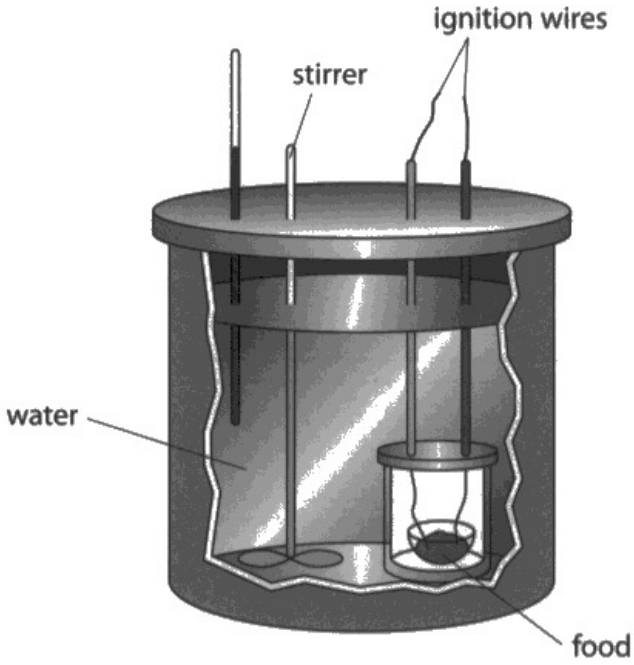


Figure 1

The mass of the food sample is measured at the start.

The food sample is burnt and the temperature rise of the water is measured.

(a) (i) Describe how the temperature rise of the water is measured.

(2)

The water is stirred to ensure the temperature is consistent throughout. Then a thermometer is placed in the water to measure the temperature. Leave the thermometer in the water for about a minute to allow it to get to the right temperature.

ResultsPlus
Examiner Comments

This response recognised that a thermometer is the equipment needed but did not indicate how the temperature rise would be obtained so only gained one mark.

1 A bomb calorimeter is used to measure the energy content of a food sample.

Figure 1 shows a bomb calorimeter.

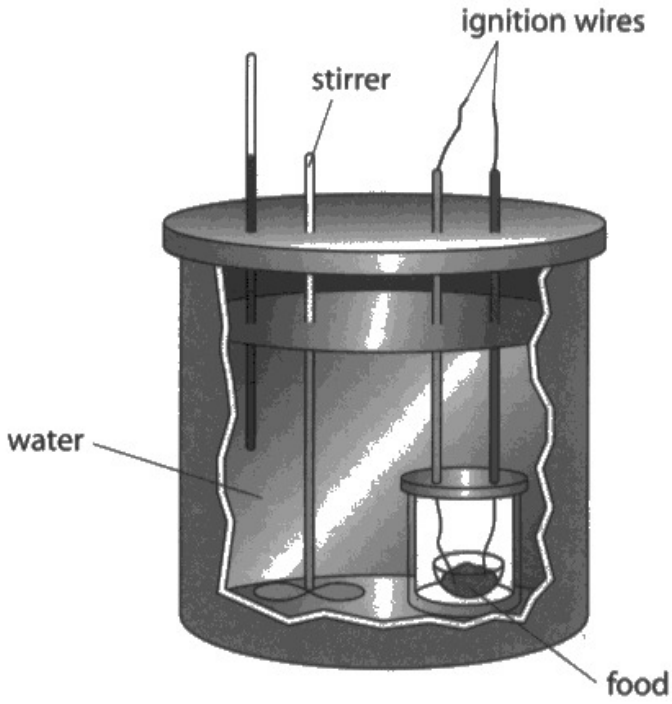


Figure 1

The mass of the food sample is measured at the start.

The food sample is burnt and the temperature rise of the water is measured.

(a) (i) Describe how the temperature rise of the water is measured.

(2)

It is measured by a thermometer. Firstly, record the original temperature, then the temperature of the water after the food sample is burnt. The difference is the temperature rise.

ResultsPlus
Examiner Comments

This scored two marks for the use of a thermometer measuring the original temperature and the temperature after the food was burnt.

Question 1 (a)(iii)

Candidates were required to recognise the reasons why a different biscuit would produce a higher temperature rise. Most candidates recognised that the biscuit had more energy or more calories. A few suggested the mass of water was lower which was also credited. Answers that just referred to different ingredients, different energy content or different mass of water were not credited.

(iii) A different biscuit with the same mass gave a temperature rise of 78.2 °C.

Give **one** reason why this biscuit gave a greater temperature rise.

(1)

It had different ingredients

ResultsPlus
Examiner Comments

This did not gain credit as it does not indicate why there would be a greater temperature rise.

ResultsPlus
Examiner Tip

When giving reasons avoid using the word different, be specific, is something higher, lower or how is it different?

(iii) A different biscuit with the same mass gave a temperature rise of 78.2 °C.

Give **one** reason why this biscuit gave a greater temperature rise.

(1)

there was less water so there was less to heat

ResultsPlus
Examiner Comments

This was accepted as it would lead to a greater temperature rise in the water even if the energy content of the biscuit was the same.

(iii) A different biscuit with the same mass gave a temperature rise of 78.2 °C.

Give **one** reason why this biscuit gave a greater temperature rise.

(1)

There is more glucose than the first biscuit

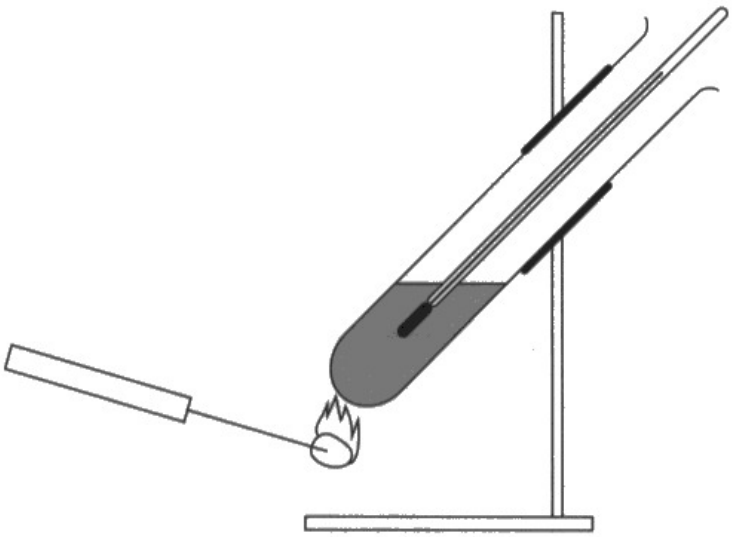
ResultsPlus
Examiner Comments

Specific ingredient differences that would cause an increase in temperature were accepted and this gained one mark.

Question 1 (b)

This question draws on practical skills knowledge to enable candidates to explain why a bomb calorimeter is more accurate than the equivalent laboratory apparatus. Marks were awarded for recognising that the bomb calorimeter was a closed system, which prevented heat loss so that all heat was transferred to the water as well as the benefit of a stirrer to evenly distribute the heat. Candidates scored well on the item but some had a tendency to repeat content by stating the reverse argument and not extending their responses. For example, the bomb calorimeter has a lid and the laboratory equipment is not sealed address the same mark scheme point.

(b) Figure 2 shows the equipment used in a school laboratory to measure the energy content of a food sample.



Explain why a bomb calorimeter gives a more accurate value than this equipment for the energy content of a food sample.

(3)

Because the temprature is better controlled in a calorimeter than a lit splint. The ~~calo~~ calorimeter also contain a stirrer which ensure the temprature is the same throughout and one spot is not hotter than the rest. The heat source is also electrical making it more reliable than a splint on fire.

ResultsPlus
Examiner Comments

This only makes one comparison between the two sets of equipment and gained one mark for the stirrer ensuring the temperature was the same throughout.

ResultsPlus
Examiner Tip

The command word was explain for this question which means that statements made need to be justified with scientific knowledge.

(b) Figure 2 shows the equipment used in a school laboratory to measure the energy content of a food sample.

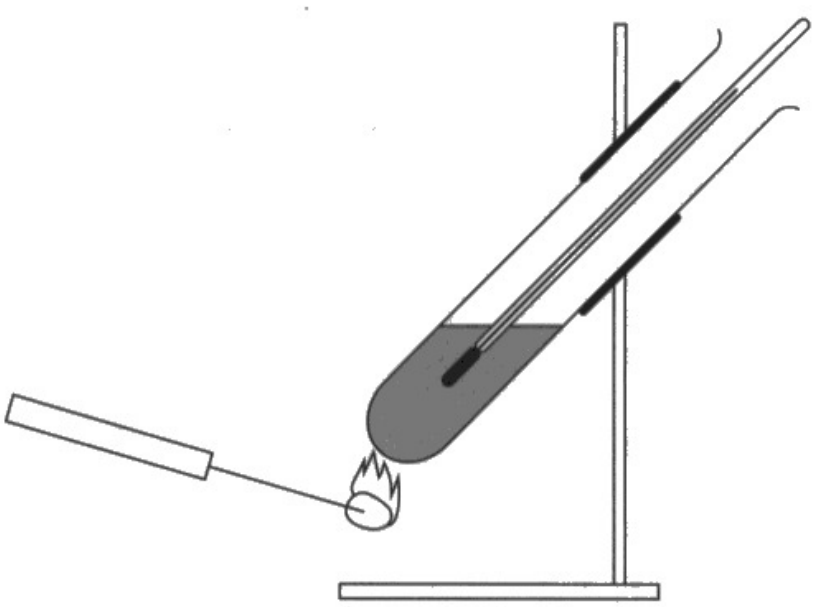


Figure 2

Explain why a bomb calorimeter gives a more accurate value than this equipment for the energy content of a food sample.

(3)

. There is a lid, which prevents heat loss to the surroundings.
. The water can be stirred more effectively
. There are ignition wires to heat the food more effectively.

ResultsPlus
Examiner Comments

This gained two marks for linking a lid to the idea of preventing heat loss. They did not link the stirring to even distribution of heat so were not awarded this mark.

(b) Figure 2 shows the equipment used in a school laboratory to measure the energy content of a food sample.

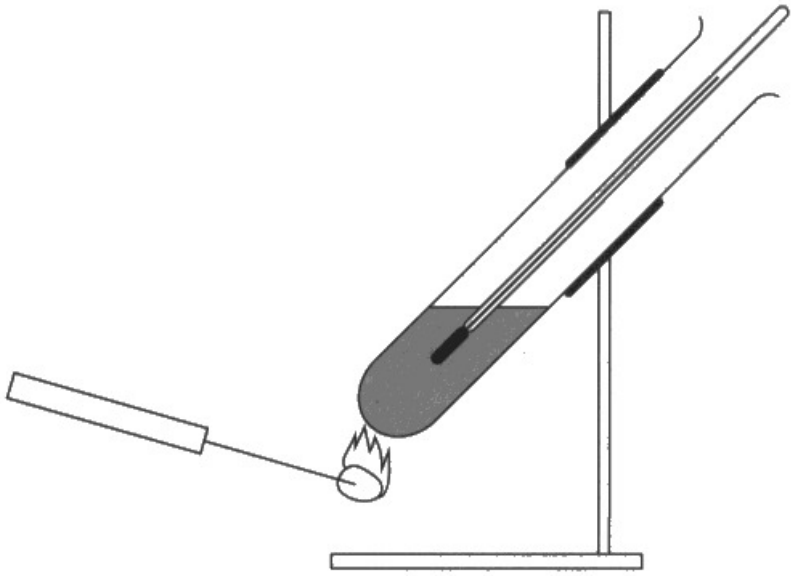


Figure 2

Explain why a bomb calorimeter gives a more accurate value than this equipment for the energy content of a food sample.

(3)

• bomb calorimeter has a lid and an insulating casing, therefore less heat is lost to the surroundings and most of the food's heat energy is used to heat the water, unlike in this equipment making the results more accurate

• bomb calorimeter has a stirrer ensuring the heat is distributed evenly throughout the water, making the results more accurate (unlike this equipment)

• bomb calorimeter uses ignition wires and powdered food to ensure all of food is burnt and all energy used up rather than a piece of food and a bunsen burner.

ResultsPlus
Examiner Comments

This is a detailed response gaining full marks. They have linked the lid to less heat is lost to the surrounding meaning that most of the heat energy is used to heat the water. It would also have obtained marks for the stirring distributing the heat evenly and for all the food burnt.

Question 2 (a)

The type of reproduction that produces genetically identical offspring is asexual. Mitosis is a cell division process which produces genetically identical cells.

2 (a) Name the type of reproduction that produces genetically identical organisms.

(1)

Mitosis

ResultsPlus
Examiner Comments

This was not accepted as it is a type of nuclear division and not a type of reproduction.

2 (a) Name the type of reproduction that produces genetically identical organisms.

(1)

mitosis asexual reproduction

ResultsPlus
Examiner Comments

This scored the mark as mitosis is not specifically incorrect as it is needed as part of asexual reproduction so the asexual reproduction was credited.

ResultsPlus
Examiner Tip

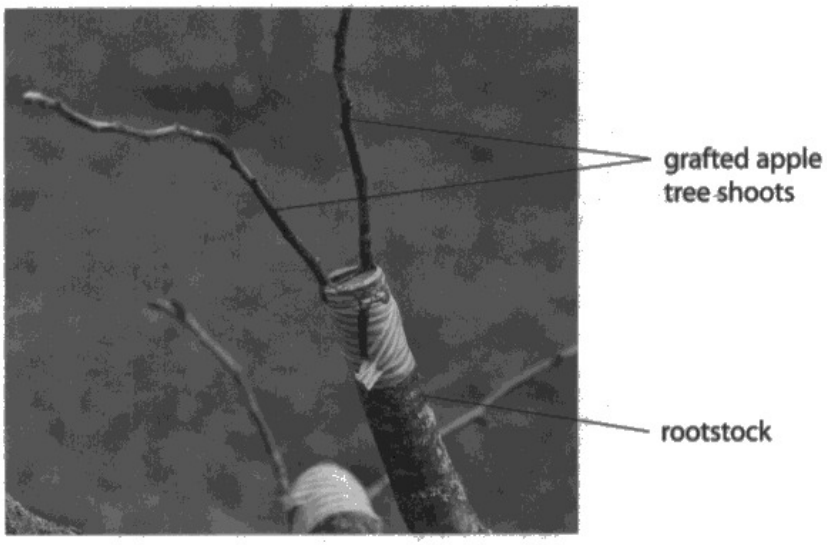
Avoid giving two names for a process when asked for one as if one is incorrect, you will not gain the mark even if the other is correct.

Question 2 (b)

This question required the application of the knowledge of mitosis which produces genetically identical cells and how this can be an advantage and disadvantage. Most candidates recognised that genetically identical plants are susceptible to the same disease and many recognised the advantage of the grafting technique which allowed production of apples with desired characteristics. Some candidates repeated information given in the question, that they were genetically identical and therefore the same without elaborating.

(b) Grafting is a technique used to grow some varieties of apple tree.

Figure 3 shows apple tree shoots grafted on to a rootstock.



(Source: © ATTILA Barsan/Shutterstock)

Figure 3

Grafting can be used to produce apple trees that are genetically identical.

Give **one** advantage and **one** disadvantage of growing genetically identical apple trees.

(2)

advantage

more of the same crop produced/ yeild increases.

disadvantage

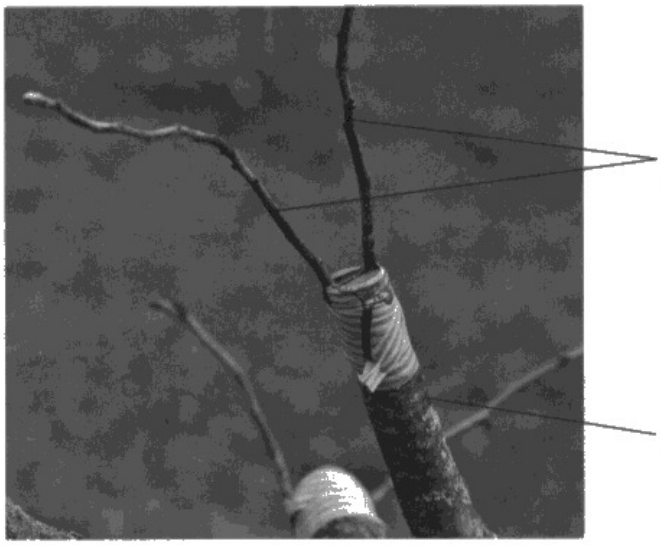
they may all be wipped out by a disease as they are genetically identical.

ResultsPlus
Examiner Comments

Yield would not necessarily be increased unless it was the specific desired characteristic, the same crop produced is just repeating the idea of genetically identical. The susceptibility to disease is creditworthy and this scores 1 mark.

(b) Grafting is a technique used to grow some varieties of apple tree.

Figure 3 shows apple tree shoots grafted on to a rootstock.



(Source: © ATTILA Barsan/Shutterstock)

Figure 3

Grafting can be used to produce apple trees that are genetically identical.

Give **one** advantage and **one** disadvantage of growing genetically identical apple trees.

(2)

advantage

They will always posses the desired characteristics e.g. sweet apples.

disadvantage

Reduces variation and biodiversity making them more susceptible to diseases

ResultsPlus
Examiner Comments

Having a desired characteristic such as sweet apples is the advantage and the disadvantage mark is awarded for susceptible to disease. Less variation is repeating information from the question which states genetically identical. Reduced biodiversity would also have been credited as equivalent to reduced gene pool.

Question 2 (c)

Overall this question was answered well and showed that many candidates had completed the practical activity. Many candidates had used a spotting tile for continuous sampling but some showed that they had incubated the enzyme and starch at a specific pH before adding iodine after a set time and observing the colour. Many candidates across a range of abilities included the idea of controlling variables and the repetition of the investigation at different pH values and the expected outcome for results and thus scored full marks. Some candidates confused the positive and negative results for starch using iodine or confused it with other food tests and referred to incorrect colours. Some candidates had not fully read the introduction to the question and included the idea of adding an apple to the investigation.

(c) As apples ripen, enzymes convert starch into sugars.

Devise a method to find the optimum pH of an enzyme that breaks down starch.

You may use standard laboratory equipment and the solutions listed in the box.

starch solution	enzyme solution	iodine solution
a range of pH solutions		

(4)

1) you would put 2/3 drops of starch solution into a software will circle in.
2) you would then add enzyme solution into the pH solution
3) mix it together, using a pipette you then need to drop some of the enzyme solution onto the starch solution.
4) keep repeating Step 3 ~~until~~ with different pH levels until the starch has changed colours.

ResultsPlus
Examiner Comments

This is a limited method. They gain two marks for combining the three solutions and repeating at different pHs. 2/3 drops is not sufficient for the idea of controlling a variable.

ResultsPlus
Examiner Tip

When given a list of solutions or apparatus make sure to include them all in your method.

(c) As apples ripen, enzymes convert starch into sugars.

Devise a method to find the optimum pH of an enzyme that breaks down starch.

You may use standard laboratory equipment and the solutions listed in the box.

starch solution	enzyme solution	iodine solution
a range of pH solutions		

(4)

In a test tube, mix 2cm³ of amylase solution, 2cm³ of starch solution and 1cm³ of a recorded chosen pH solution. In a dimple tile, in each dimple place one drop of iodine solution. Every 20 seconds, place one drop of the ~~mixture~~ starch-amylase-pH solution into a fresh dimple until the resulting solution remains the same colour (yellowish, was initially blue-black before starch was broken down). Count how many dimples were required for all the starch to be broken down (and thus how long it took, the rate of reaction). Record time and

ResultsPlus
Examiner Comments

This response gained full marks for 2cm^3 amylase, which is controlling a variable, it combined the three solutions, iodine was added to the dimple tray and the correct colour changes for the result. It would also gain a mark for repeating with different pH solutions which is visible at the bottom of the clip.

Question 2 (d)

Candidates of all abilities answered this well with most gaining full marks for linking the idea of denaturing to the active site. Candidates who scored one mark had repeated the question, referring to the enzyme denaturing so it would not work.

(d) The optimum pH of an enzyme is pH 6.

Explain why this enzyme would not work at pH 10.

(2)

The enzyme's active site will Denature and the substrate will not fit inside the active site

ResultsPlus
Examiner Comments

This gains full marks, they have included multiple aspects including the active site denaturing which is two marks and also the substrate not being able to fit.

(d) The optimum pH of an enzyme is pH 6.

Explain why this enzyme would not work at pH 10.

(2)

- the conditions are too alkaline
- the enzyme would denature
- the active site of the enzyme would change shape so would no longer be complementary to the substrate to bind to and break it down

ResultsPlus
Examiner Comments

This response gained full marks and uses key scientific terminology accurately.

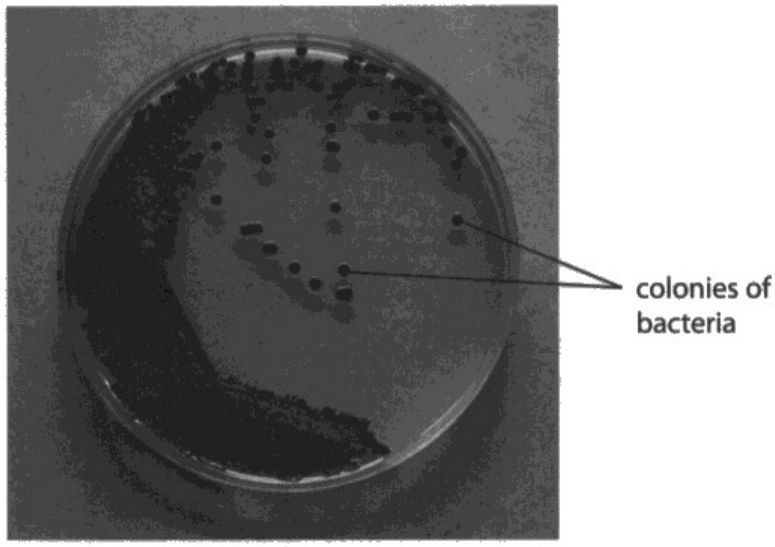
ResultsPlus
Examiner Tip

Writing answers as bullet points is a good exam technique as it can prevent you repeating the question and ensures you include sufficient information to gain full marks on a question.

Question 3 (a)

This question required candidates to recognise that there are 10 doublings within a five hour period. 2^{10} results in a population size of 1024 but many candidates did not access it using that method and worked out each individual populations number for 10 doublings. Some candidates did not count the first 30 minutes as a doubling point and calculated 512. Answers of 512 and those that showed 10 in the working obtained one mark.

3 Figure 4 shows colonies of bacteria growing on an agar plate.



(Source: © Chatchouliya/Shutterstock)

Figure 4

Each colony starts as one bacterium.

Every time bacteria reproduce, the number of bacteria in each colony doubles.

(a) Calculate the number of bacteria in a colony after five hours, if each bacterium reproduces every 30 minutes.

(2)

5h = 10 × 30 min

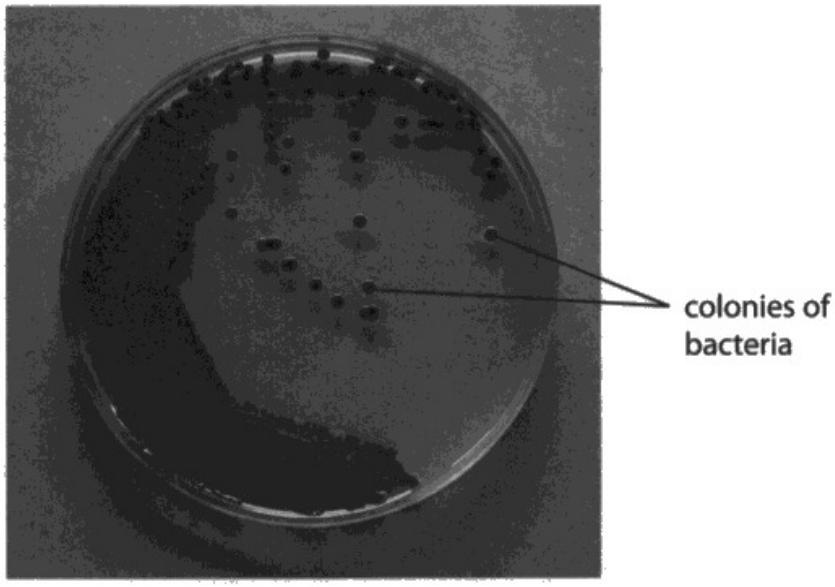
1, 2, 4, 8, 16, 32, 64, 128, 256, 512

512 bacteria

ResultsPlus
Examiner Comments

This gained one mark for either 512 or 10 doublings. The candidate has not recognised that after doubling number 1 there will be 2 bacteria. Essentially only calculating 9 doublings.

3 Figure 4 shows colonies of bacteria growing on an agar plate.



(Source: © Chatchouliya/Shutterstock)

Figure 4

Each colony starts as one bacterium.

Every time bacteria reproduce, the number of bacteria in each colony doubles.

(a) Calculate the number of bacteria in a colony after five hours, if each bacterium reproduces every 30 minutes. **(2)**

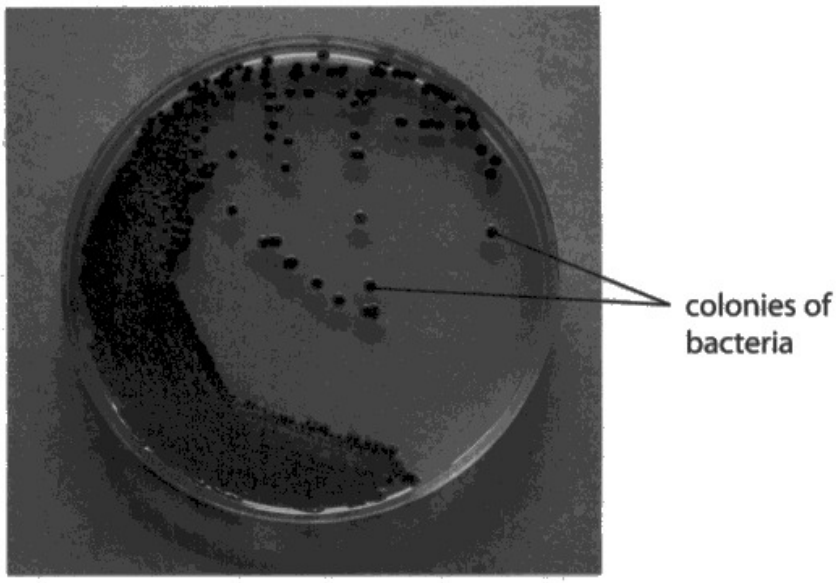
10 5 x 5 hours. = 10 x 30 mins.

300 bacteria

ResultsPlus
Examiner Comments

This candidate recognised that there are 10 doublings in 5 hours, scoring one mark.

3 Figure 4 shows colonies of bacteria growing on an agar plate.



(Source: © Chatchouliya/Shutterstock)

Figure 4

Each colony starts as one bacterium.

Every time bacteria reproduce, the number of bacteria in each colony doubles.

(a) Calculate the number of bacteria in a colony after five hours, if each bacterium reproduces every 30 minutes.

2 x 5 = 10

(2)

$1 \times 2^{10} = 1024$

1024 bacteria

ResultsPlus
Examiner Comments

This response shows the correct and quick method for calculating bacteria population sizes, gaining full marks for the correct answer.

ResultsPlus
Examiner Tip

Bacteria population can be calculated using 2 to the power of the number of doublings in the time period.

Question 3 (b)(i)

Pathogen is a key scientific term from the specification but many candidates were not able to give the meaning. The mark was awarded for causing disease, illness or infection. Responses that didn't obtain the mark indicated that pathogens spread disease rather than causing it, or just gave examples of pathogens and not the meaning.

(b) Some bacteria are pathogens.

(i) State the meaning of the term pathogen.

(1)

A pathogen is something that carries disease or infection from person to person.

ResultsPlus
Examiner Comments

Pathogens do not carry disease they cause disease. Vectors such as mosquitoes carry disease.

(b) Some bacteria are pathogens.

(i) State the meaning of the term pathogen.

(1)

A a invasive microorganism that causes harm.

ResultsPlus
Examiner Comments

Causing harm is not specific enough, it needed to be the idea of causing disease.

(b) Some bacteria are pathogens.

(i) State the meaning of the term pathogen.

(1)

Bactria that ~~causes disease~~ infects the bodily cells causing disease.

ResultsPlus
Examiner Comments

Bacteria is an example of a pathogen not the meaning but this response has causing disease which is sufficient for the mark.

Question 3 (b)(ii)

Most candidates recognised that antibiotics kill bacteria or inhibit reproduction for one mark but the mechanisms were not fully explained, with many candidates linking it to the production of antibodies or the role of the immune system. Higher ability candidates scored full marks for linking their explanation to the inhibition of process in the bacterial cells, frequently referencing the cell wall in their answers.

(ii) Explain why antibiotics can be used to treat bacterial infections.

(2)

As they weaken the cell wall of bacteria which causes the cell to burst open and outside factors then kill the bacteria cell

ResultsPlus
Examiner Comments

This has weaken the cell wall linked to the idea of killing the bacteria for both marks.

(ii) Explain why antibiotics can be used to treat bacterial infections.

(2)

aid your immune system to antibiotics, fight off and kill pathogens and antigens, they prevent them from reproducing

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Examiner Comments

This has killing pathogens or preventing them reproducing which is the same marking point for one mark.

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Examiner Tip

Fight off is not a scientific way to describe the immune system.

(ii) Explain why antibiotics can be used to treat bacterial infections.

(2)

Antibiotics can be used to treat bacterial infections as they have the right lymphocytes in the white blood cells to fight of the bacteria.

ResultsPlus
Examiner Comments

This scored zero as the link to lymphocytes is incorrect and fight off is not a scientific explanation.

ResultsPlus
Examiner Tip

Don't repeat the information given in the question as part of your answers.

Question 3 (b)(iii)

Candidates were given the image length and the actual length of a bacterium and asked to calculate the magnification. Most candidates of all ability scored full marks. Incorrect responses multiplied the two numbers or inverted the division calculation, resulting in too small a number for a magnification.

(iii) A rod-shaped bacterium is 0.005 mm long.

A student draws the rod-shaped bacterium.

The bacterium in the drawing is 80 mm long.

Calculate the magnification of this drawing.

(2)

Real image / ~~A Drawing~~ Drawing image

$\frac{0.005}{80} = 6.25 \times 10^{-5}$

$\frac{80}{0.005} = 16000$

magnification = ~~16~~ 6.25×10^{-5}

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Examiner Comments

This calculation does not correctly use the equation to calculate magnification.

ResultsPlus
Examiner Tip

Consider if your answer is a sensible number for the question. A magnification will always be a big number not a decimal.

(iii) A rod-shaped bacterium is 0.005 mm long.

A student draws the rod-shaped bacterium.

The bacterium in the drawing is 80 mm long.

Calculate the magnification of this drawing.

(2)

magni = image length / object length

= 80 mm / 0.005 → ×1600

magnification = × 1600

ResultsPlus
Examiner Comments

This candidate scored one mark for the correct calculation being shown but their answer is incorrect.

(iii) A rod-shaped bacterium is 0.005 mm long.

A student draws the rod-shaped bacterium.

The bacterium in the drawing is 80 mm long.

Calculate the magnification of this drawing.

(2)

MEA M = I / A

= 80 / 0.005

= 16000X

magnification = X 16000

ResultsPlus
Examiner Comments

This candidate scored full marks for correctly calculating 16 000.

Question 4 (a)(i)

This calculation question required candidates to determine the percentage of people who needed glasses to correct their vision and then calculate the number of people this represented out of a sample of 240. Candidates approached it in different ways but most obtained the correct answer and scored full marks. Some determined that 84 people could read the normal vision row and did not go on to do any further calculations gaining one mark. A number of incorrect responses calculated 75% rather than 65%, presumably from incorrectly subtracting 35% from 100.

4 Figure 5 shows a chart used by opticians to test a person's vision.

The person's vision is judged by the lowest row of letters they can read.

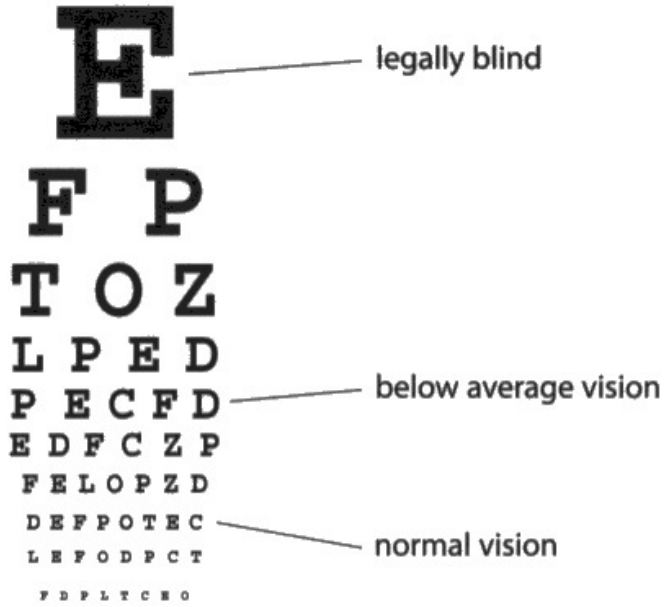


Figure 5

(a) (i) An optician tested the eyesight of 240 people.

35% of these people could read the normal vision row without wearing glasses.

The rest of the people need glasses to correct their vision.

Calculate the number of people who need glasses to correct their vision.

(3)

100 - 35 = 65
240 ÷ 100 = 2.4
2.4 x 65 = 156

156 people

ResultsPlus
Examiner Comments

This candidate correctly calculated 65% of 240 people and scored three marks.

4 Figure 5 shows a chart used by opticians to test a person's vision.

The person's vision is judged by the lowest row of letters they can read.

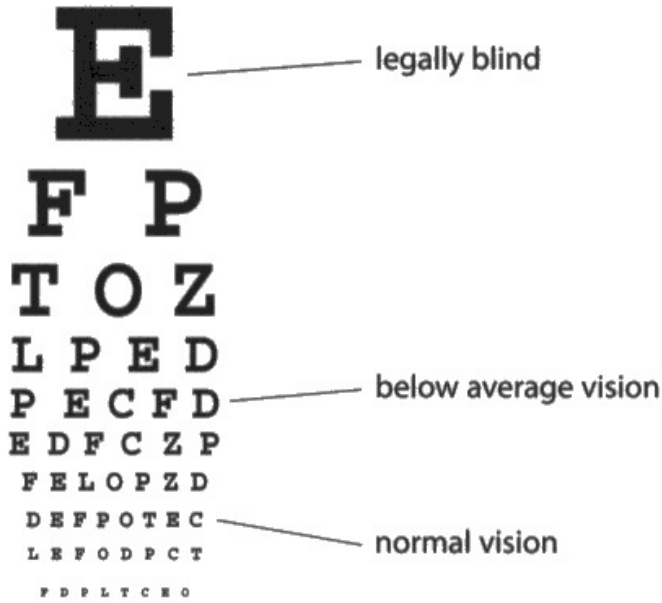


Figure 5

(a) (i) An optician tested the eyesight of 240 people.

35% of these people could read the normal vision row without wearing glasses.

The rest of the people need glasses to correct their vision.

Calculate the number of people who need glasses to correct their vision.

(3)

$\frac{240}{10} = 24$ $100\% - 35\% = 75\%$

$10\% = 24 \times 7 = 168$ 180

$5\% = 17$ +

180 people

ResultsPlus
Examiner Comments

This candidate has incorrectly calculated 75% rather than 65%. The source of the error can be identified and all further working is correct so the candidate scores two marks as an error carried forward is applied.

Question 4 (a)(ii)

Many candidates recognised that light in the eye of people who are short-sighted focuses in front of the retina, the eyeball is too long or is refracted too much. Answers that were not credited included the image forming in front of the retina, light not reaching the retina or being refracted in front of the retina.

(ii) An optician can use the chart to diagnose short-sightedness.

Give **one** reason why people are short-sighted.

(1)

As light isn't refracted properly onto the back of the retina

ResultsPlus
Examiner Comments

This scored zero as it doesn't give the reason for short-sightedness as it doesn't say what happens to the light.

ResultsPlus
Examiner Tip

Be specific in your answers.

(ii) An optician can use the chart to diagnose short-sightedness.

Give **one** reason why people are short-sighted.

(1)

Short-sightedness occurs when eye is too long so image focuses before the retina.

ResultsPlus
Examiner Comments

This scored the mark for eye being too long. The image forming before the retina is incorrect, it is the light focusing before the retina.

(ii) An optician can use the chart to diagnose short-sightedness.

Give **one** reason why people are short-sighted.

(1)

Their Lens refracts light too much so it focuses before the retina.

ResultsPlus
Examiner Comments

This could have obtained the mark for the light being refracted too much or for it focusing before the retina.

Question 4 (b)(i)

This question asked for a description of why a person with cataracts sees a blurred image. Many candidates recognised that this was due to a build-up of protein in the lens, however some candidates only referred to a cloudy lens or a build-up of protein in the pupil and scored one mark. Few responses went further to describe that this causes dispersion of light which result in the blurred image.

(b) Cataracts can affect a person's vision.

Figure 6 shows what a person with normal vision and a person with cataracts can see for the top letter on the optician's chart.

person with normal vision person with cataracts

Figure 6

(i) Describe why a person with cataracts would see the image shown in Figure 6.

(2)

A person with cataracts has cloudy patches on the lens, making ~~the~~ their vision blurred.

ResultsPlus
Examiner Comments

This scores one for the lens, the cloudy patches is not sufficient for protein.

(b) Cataracts can affect a person's vision.

Figure 6 shows what a person with normal vision and a person with cataracts can see for the top letter on the optician's chart.

person with normal vision person with cataracts

Figure 6

(i) Describe why a person with cataracts would see the image shown in Figure 6.

(2)

Cataracts are are caused by a build up of proteins on the surface of the eyes. These proteins partially block light, making their vision blurry.

ResultsPlus
Examiner Comments

This scores two marks for protein (mark point 1). The surface of the eye was not sufficient for the lens but partially blocking light is correct for the final marking point.

Question 4 (b)(ii)

This question asked for the treatment with cataracts and marks were obtained for replacing the lens or using an artificial lens. The idea of just removing the cataracts or laser eye surgery were not sufficient for credit.

(ii) State the treatment for cataracts.

(1)

Replace the faulty lens with an artificial lens.

ResultsPlus
Examiner Comments

This is a correct treatment for cataracts and scores one mark.

(ii) State the treatment for cataracts.

(1)

laser eye surgery.

ResultsPlus
Examiner Comments

This is not specific as laser eye surgery is used for lots of different reasons.

Question 4 (c)(ii)

Most candidates recognised the involvement of motor neurone in the transfer of messages from the brain to muscles. Some candidates gave details of a full reflex or the role of the relay neurone but provided the motor neurone was in the correct location this was credited. Fewer candidates referred to electrical impulses and some did not gain this mark for electric or electricity.

(ii) When a person reacts to a stimulus, messages from the brain are sent to their muscles.

Describe how messages are sent from the brain to muscles.

(2)

Via the motor neurone. The impulse travels through the CNS (brain). Then the impulse is passed to the motor motor neurone and then impulse is passed to the effector (muscles) which carry out the response.

(Total for Question 4 = 11 marks)

ResultsPlus
Examiner Comments

This scored one mark for the motor neurone. It needs to be the electrical impulse or electrical signal.

(ii) When a person reacts to a stimulus, messages from the brain are sent to their muscles.

Describe how messages are sent from the brain to muscles.

(2)

Electrical impulses are sent from receptors along the axons of neurones to the effectors (muscles) ~~along~~ via the CNS.

ResultsPlus
Examiner Comments

This has the electrical impulses mark but does not refer to a motor neurone so only gains one mark.

(ii) When a person reacts to a stimulus, messages from the brain are sent to their muscles.

Describe how messages are sent from the brain to muscles.

(2)

electrical impuise from relay neurone traves across the synapse to the motor neurone to the effector

ResultsPlus
Examiner Comments

This scores full marks for linking the transmission of an electrical impulse to the motor neurone.

Question 5 (a)(ii)

The chromosome number of a mouse sperm cell is 20. Candidates needed to recall that sperm have a haploid nucleus and calculate the number of chromosomes from the diploid number of 40. Most candidates, of a range of abilities were able to do this successfully.

Question 5 (b)(ii)

This question asked candidates to describe how stem cells produce the cells of an embryo. Some candidates described the properties of stem cells rather than answering the question asked. Most candidates scored one mark for the idea of differentiating or forming specialised cells but did not recognise that the cells of an embryo need to divide by mitosis to enable growth to occur.

(ii) The genetically identical stem cells produce the cells that develop into an embryo.

Describe how stem cells produce the cells of an embryo.

(2)

They divide by mitosis and then become specilised and change their function and structure to one with a specific role. This develops into a functioning embryo

ResultsPlus
Examiner Comments

This scored full marks for recognising that the development of the embryo is a growth process that needs cell division by mitosis and the production of specialised cells.

(ii) The genetically identical stem cells produce the cells that develop into an embryo.

Describe how stem cells produce the cells of an embryo.

(2)

stem cells divide a few times, and as they divide, they change in order to carry out a specific function e.g. muscle cells or blood cells

ResultsPlus
Examiner Comments

Cell dividing was not enough as it did not mention mitosis but this scored one mark for the idea of forming named specialised cells.

Question 5 (c)(i)

Many candidates recognised that a transplant between siblings reduced the chance of rejection and gained the mark. Some candidates understood that this was linked to similar genetics. Marks were not awarded for the same DNA as they are not identical twins nor for the same blood group as this doesn't ensure compatibility.

(c) Scientific research has made many discoveries and developments allowing stem cells to be used in medical treatments.

Figure 9 shows a timeline for some of these discoveries and developments.

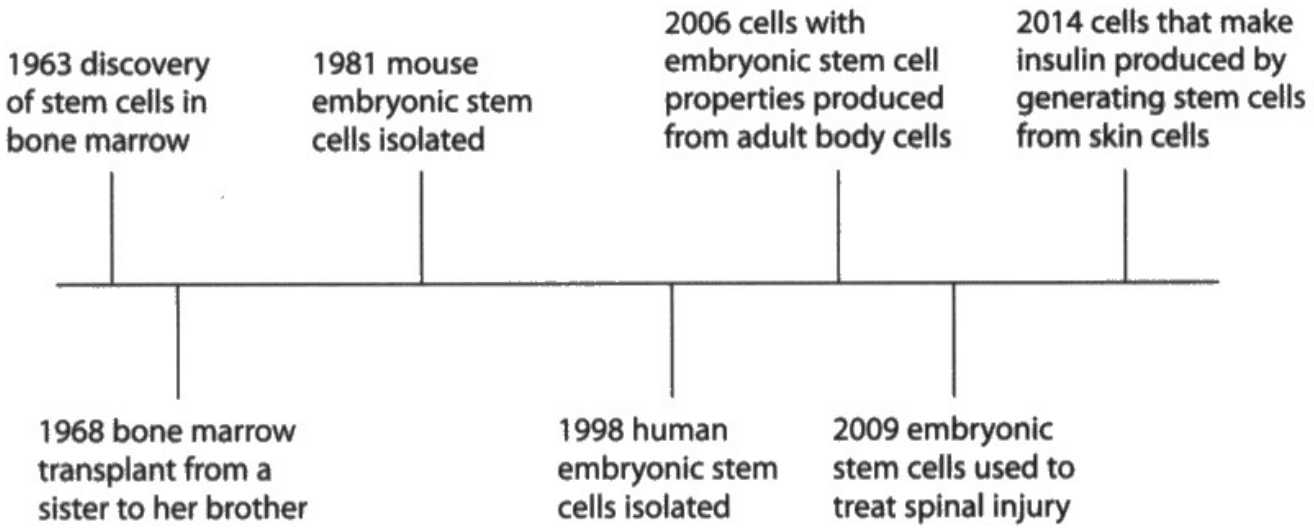


Figure 9

(i) Give **one** scientific reason why the bone marrow transplant in 1968 was from a sister to her brother.

(1)

There was less of a risk that the body would reject the cells

ResultsPlus
Examiner Comments

This was a commonly seen response which recognised the idea of reducing the chance of rejection.

(c) Scientific research has made many discoveries and developments allowing stem cells to be used in medical treatments.

Figure 9 shows a timeline for some of these discoveries and developments.

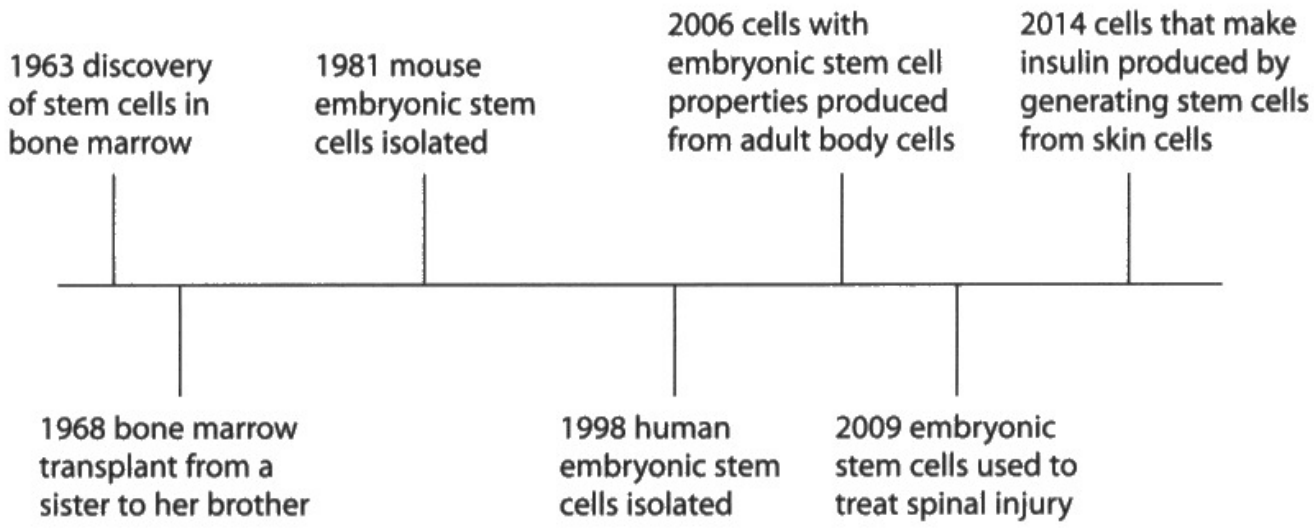


Figure 9

(i) Give **one** scientific reason why the bone marrow transplant in 1968 was from a sister to her brother.

(1)

~~They have~~ The bone marrow is more likely to be accepted by the brother's immune system.

ResultsPlus
Examiner Comments

This is the reverse argument of reducing the chance of rejection and scored the mark.

Question 5 (c)(ii)

Many candidates obtained the mark for this with linking the idea of the embryonic stems cells being linked to the potential for life. Some candidates stated that stem cells could continue to divide and cause tumours which did not gain credit as it is not linked to the isolation aspect.

(ii) Give **one** scientific reason why some people are opposed to the isolation of human embryonic stem cells.

(1)

They believe that it is unethical to tamper with nature and living organisms such as stem cells

ResultsPlus
Examiner Comments

The idea of unethical was accepted for one mark.

(ii) Give **one** scientific reason why some people are opposed to the isolation of human embryonic stem cells.

(1)

embryonic stem cells divide rapidly and can cause a tumour to form if cell division is not controlled.

ResultsPlus
Examiner Comments

This is not a reason that people are opposed to the isolation of human embryonic stem cells specifically.

Question 5 (c)(iii)

This question required the application of knowledge on stem cells to their use in medicine. Marks were mainly awarded for the idea of not needing to find a donor or the use of embryonic stem cells, that the cells would not be rejected and that these cells could not differentiate into any cell. Some candidates gave the idea of not needing to take immunosuppressant's which was accepted or that the damaged cells could be released. The idea of repairing damaged cells was not accepted nor the idea that the stem cells could differentiate into anything.

(iii) Stem cells, with the properties of embryonic stem cells, can be produced from a patient's own skin cells.

Discuss the benefits of using these stem cells to treat the patient.

(3)

there is no chance the body will reject the stem cell as they have the same DNA as the ~~the~~ recipeant because it comes from the same ~~person~~ person. Another benefit is that embryonic stems cells don't need to be used so there is less of a moral dilema.

ResultsPlus
Examiner Comments

This scored two marks in total for no chance of rejection and for embryonic stem cells not being used.

(iii) Stem cells, with the properties of embryonic stem cells, can be produced from a patient's own skin cells.

Discuss the benefits of using these stem cells to treat the patient.

(3)

they would be genetically the same as the patient, meaning the patients body would be less likely to reject them. They would also eliminate the need for a donor because the patient donates them. Also, the patient would not need to donate many as the cells can multiply through cell division.

ResultsPlus
Examiner Comments

This scored two marks for less likely to be rejected and that it would eliminate the need for a donor.

(iii) Stem cells, with the properties of embryonic stem cells, can be produced from a patient's own skin cells.

Discuss the benefits of using these stem cells to treat the patient.

(3)

~~embryo~~ embryos don't have to be destroyed. the stem cells can differentiate into any type of cell instead of limited like adult stem cells. the body is less likely to reject stem cells if they are from your own body. as the body will recognise them and not attack them

ResultsPlus
Examiner Comments

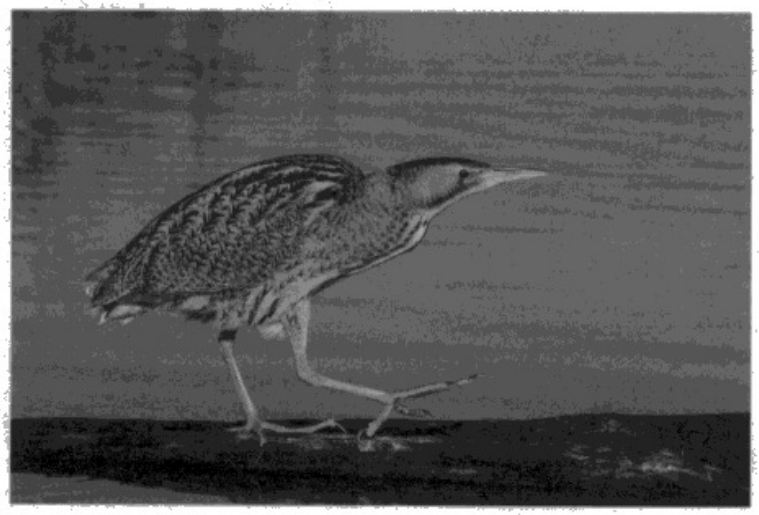
This scored full marks for embryos do not need to be destroyed, the stem cells can differentiate into any type of cell and that they are less likely to be rejected.

Question 6 (a)(i)

Calculating a percentage increase is more challenging than a straightforward calculation but was performed more successfully than previous series. The first mark was awarded for calculating the difference in the population size, the second mark is for the idea of dividing by the starting population size and then obtaining the correct answer. Candidates who didn't calculate the difference in population size but divided by the starting population gained two marks. Full marks are awarded for the correct answer, irrespective of whether workings are shown. Some candidates lost marks by not rounding their calculation correctly or for using recurring numbers incorrectly.

6 (a) In the 19th century the destruction of wetland habitats caused the extinction of the bittern in the UK.

Figure 10 shows a bittern.



(Source: © Ildiko Laskay/Shutterstock)

Figure 10

Restoration of the habitats has led to the birds returning to the UK.

Male bitterns make a loud booming sound.

This allows the numbers of male bitterns to be counted.

In 1997, 11 males were counted and this increased to 221 males in 2021.

(i) Calculate the percentage increase in the number of males from 1997 to 2021.

(3)

$\frac{\text{final - initial}}{\text{initial final}} = \frac{221-11}{221} = 0.95 \times 100 = 95\%$

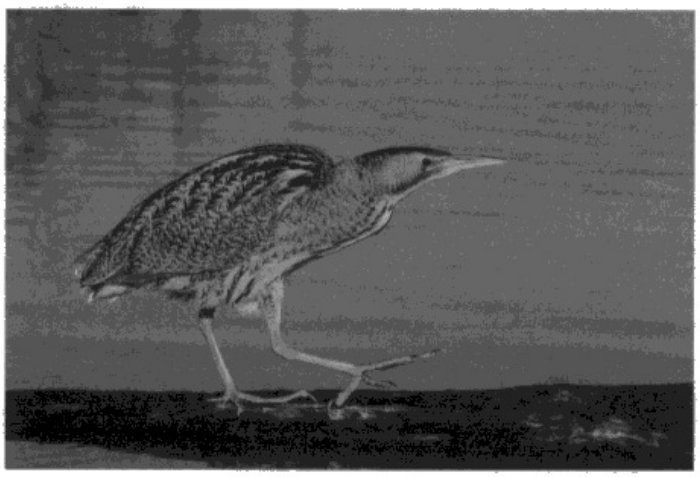
95% %

ResultsPlus
Examiner Comments

This candidate scored one mark for calculating the difference in the population but they divided by the final population size which is incorrect.

6 (a) In the 19th century the destruction of wetland habitats caused the extinction of the bittern in the UK.

Figure 10 shows a bittern.



(Source: © Ildiko Laskay/Shutterstock)

Figure 10

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This allows the numbers of male bitterns to be counted.

In 1997, 11 males were counted and this increased to 221 males in 2021.

(i) Calculate the percentage increase in the number of males from 1997 to 2021.

(3)

$\frac{221 - 11}{11} \times 100 = 1909.\dot{0}\dot{9}$

1909.09 %

ResultsPlus
Examiner Comments

This shows the correct calculation for full marks.

ResultsPlus
Examiner Tip

Make sure answers are rounded correctly and recurring numbers are shown correctly. The 09 is recurring and not just the 9.

Question 6 (a)(ii)

Candidates of all abilities answered this question well with most linking their answer to being hidden from predators or being camouflaged. Many candidates also linked this to the idea of increased survival.

The bitterns are difficult to see in the reeds of the wetland habitat.

(ii) Give **one** benefit of this to the bittern.

(1)

there would be less competition between other species

ResultsPlus
Examiner Comments

This does not answer the question as it is not a benefit of being difficult to see in the reeds.

The bitterns are difficult to see in the reeds of the wetland habitat.

(ii) Give **one** benefit of this to the bittern.

(1)

Easier from them to catch prey

ResultsPlus
Examiner Comments

This is one possible benefit of being hidden in the reeds.

The bitterns are difficult to see in the reeds of the wetland habitat.

(ii) Give **one** benefit of this to the bittern.

(1)

They will be harder to see by predators, meaning they have a better likelihood of surviving.

ResultsPlus
Examiner Comments

Being harder to see by predators was the most common idea seen for this question. This response also has the idea of increased survival.

Question 6 (a)(iii)

This question asked candidates to explain why having animals that were closely related made the species susceptible to extinction, utilising their knowledge of natural selection. Most candidates scored at least two marks for recognising that closely related animals were all susceptible to the same disease or change in the environment, which would decrease the population size. Higher ability candidates made the connection between being closely related and a lack of genetic variation.

(iii) There is some concern that the bitterns in the UK are all closely related. This could make them susceptible to extinction.

Explain, using your knowledge of natural selection, why being closely related could make the bitterns susceptible to extinction.

(3)

If all bitterns are closely related there is not much variation in the species, this would mean if one bittern is vulnerable to a disease there is a high liklihood that all bitterns are vulnerable as they are all similar, genetically.

ResultsPlus
Examiner Comments

This scores full mark for recognising the lack of variation, linked to all bitterns being susceptible to the same selection pressure, which in this case is disease.

(iii) There is some concern that the bitterns in the UK are all closely related. This could make them susceptible to extinction.

Explain, using your knowledge of natural selection, why being closely related could make the bitterns susceptible to extinction.

(3)

If they are all closely related, they could potentially go extinct if a new selection pressure comes along. This is because they all have similar characteristics so if something like a new disease or new predator was introduced that could kill just one, it could kill most of the population due to none of them having the defence mechanisms to fight them off. This selection pressure could also be a species going extinct.

ResultsPlus
Examiner Comments

This scored two marks for a new selection pressure and killing most of the population. Similar characteristics is not sufficient for less variation or the idea of genetically similar.

(iii) There is some concern that the bitterns in the UK are all closely related. This could make them susceptible to extinction.

Explain, using your knowledge of natural selection, why being closely related could make the bitterns susceptible to extinction.

(3)

If there is a disease that one bittern gets it will spread and wipe all the birds out.

ResultsPlus
Examiner Comments

Although limited in detail this does have the idea of a named selection pressure affecting all the birds for two marks.

Question 6 (b)

Candidates found this question challenging and often just repeated information from the question or gave a generic answer to a question on selective breeding without applying it to the context. Candidates needed to recognise that the selected animals needed to be genetically different or have different characteristics, not just the idea of not being related. Some candidates recognised that this could be achieved by breeding animals from different locations. The second mark was for the idea that this process must be repeated over many generations, not just the idea of repeated.

(b) Describe how selective breeding can be used to produce a large population of animals that are not closely related.

(2)

One would have to breed individuals who are varied by phenotype or genotype if possible. This over many generations would lead to a population with high variability and little genetic relation

ResultsPlus
Examiner Comments

This response scored two marks as it gives a clear idea of which animals would be selected. It also has the idea of repeating the process over many generations.

(b) Describe how selective breeding can be used to produce a large population of animals that are not closely related.

(2)

- Breed two animals that are not closely related together.
- Breed another set of two animals that are not closely related.
- Breed their offspring together and repeat over many generations.

ResultsPlus
Examiner Comments

This scored one mark for repeating the process over many generations. Breeding animals that are not closely related is the reverse of the question, there needed to be something more specific about which animals would be selected.

(b) Describe how selective breeding can be used to produce a large population of animals that are not closely related.

(2)

As you can bread to the un related animals together. Then with their offspring, ~~Bread~~ breed different unrelated offspring together. This can be continued until you have a populaho of animals unrelated.

ResultsPlus
Examiner Comments

This scored zero as unrelated is just repeating the idea from the question and continuing until you have a large population is insufficient for repeated over many generations.

Question 6 (c)

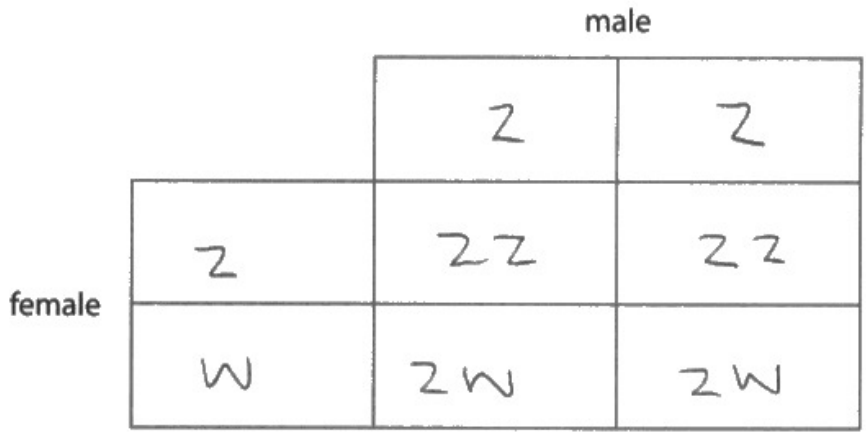
Sex determination in birds is different to humans. Candidates were given the chromosome combinations of homozygous Z for males and heterozygous ZW for female and asked to show the sex determination of offspring in a Punnett square. This was answered well by most candidates, showing that they understood the genetic terms and were able to relate their knowledge of sex determination in humans to birds.

(c) Sex determination in birds is different from humans.

Males are homozygous Z and females are heterozygous ZW.

Complete the Punnett square to show how sex is determined in birds.

(2)



ResultsPlus
Examiner Comments

This shows a correctly completed Punnett square.

(c) Sex determination in birds is different from humans.

Males are homozygous Z and females are heterozygous ZW.

Complete the Punnett square to show how sex is determined in birds.

(2)

	male	
	Z	W
female Z	ZZ	ZW
female W	ZW	WW

ResultsPlus
Examiner Comments

This scored one mark for an error carried forward. The male parental genotype is incorrect but the offspring are correct from the genotype given.

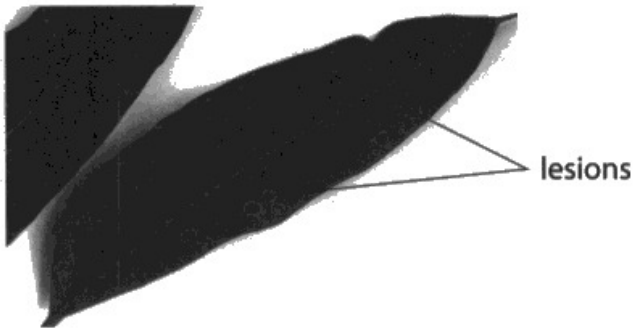
Question 7 (a)(i)

This first extended open-response question of the paper asked about a specification point that hadn't previously been covered in any detail. Candidates needed to describe how a farmer could investigate the cause of lesions on crop plants with reference to distribution analysis. The levels were awarded based on the detail of investigations that could be done in the field and by testing in a lab. Although some candidates found it difficult to extend their answer beyond the idea of looking where affected plants were located, many candidates showed detailed knowledge of how distribution analysis can be used to indicate possible causes including pathogens spread by soil, contact or airborne. High ability candidates gave detailed responses on how the cause could be investigated, referring to both environmental causes and pathogen related. Some responses digressed from the question and described experiments that could be done by placing affected crops near unaffected crops, possibly in a greenhouse which is not what a farmer would do.

7 Plant growth can be affected by the environment, by pathogens, or both.

(a) A farmer found lesions on crop plants growing in one of their fields.

Figure 11 shows lesions on leaves.



(Source: © nang nang/Shutterstock)

Figure 11

*(i) Discuss how the cause of the lesions and their spread through the crops could be investigated.

You should refer to distribution analysis in your answer.

(6)

To investigate the cause, you could start by changing an environmental factor to see if the cause of the lesions is due to this. For example, quality of soil the crops are growing in may be poor, so you can add fertiliser to add nutrients like nitrates and phosphates into the soil. If lesions are not present after doing this, one can be sure the lesions were caused due to a nutrient deficiency. Potentially, the lesions could also be caused by a pathogen. Using monoclonal antibodies which are highly specific to antigens on pathogens, one can see if a certain antigen for a pathogen is present within the plants, which would allow a person to identify the pathogen causing lesions. Pathogen DNA can also be detected in cells of the plants. In terms of distribution, if affected plants are very near one another in clusters it can be assumed that there is an issue in that specific area, for example with the soil. However, if the distribution is random, then the lesions are most likely caused by airborne pathogens.

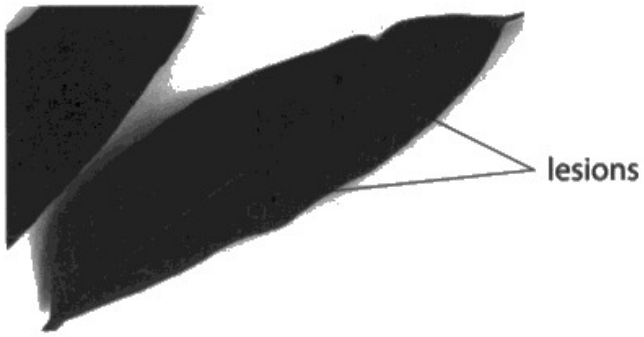
ResultsPlus
Examiner Comments

This response is Level 3. They have a detailed description of fieldwork that could be done, referring to adding fertiliser to see if the lesions disappear and in the final paragraph it refers to patterns of distribution which is also part of fieldwork. It refers to content from the testing aspect with monoclonal antibodies and detecting DNA. It gains six marks in Level 3 because it makes links between the patterns of distribution and how the lesions could be being spread.

7 Plant growth can be affected by the environment, by pathogens, or both.

(a) A farmer found lesions on crop plants growing in one of their fields.

Figure 11 shows lesions on leaves.



(Source: © nang nang/Shutterstock)

Figure 11

*(i) Discuss how the cause of the lesions and their spread through the crops could be investigated.

You should refer to distribution analysis in your answer.

(6)

Field analysis

- Plant specialists can go out onto a field and observe plants
- they carry a plant guide with them,
- as soon as they spot a plant with lesions, they find out what it is caused by e.g. nutrion deficiancy.
- once the problem is found, the farmers give plant what is required, then they observe the changes in the plant.

In the lab

- They can take a small cutting from the infected plant
- place it ~~on petri~~ on stage and observe through microscope, observe what pathogen caused the disease by observing the symptoms. ~~and the~~
- You can use fertilisers such as NPK for nutrients deficiancy.

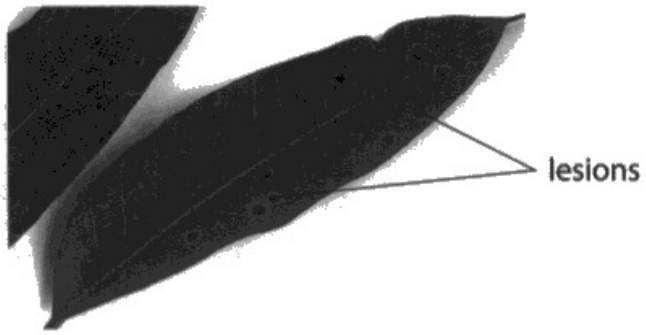
ResultsPlus
Examiner Comments

This was a Level 3 response as they describe fieldwork which extended beyond just examining the location of the crops with lesions and they have the idea of testing to identify the pathogen. They do not refer to possible patterns that could be seen in affected crops linked to possible causes, which restricts them to five marks.

7 Plant growth can be affected by the environment, by pathogens, or both.

(a) A farmer found lesions on crop plants growing in one of their fields.

Figure 11 shows lesions on leaves.



(Source: © nang nang/Shutterstock)

Figure 11

*(i) Discuss how the cause of the lesions and their spread through the crops could be investigated.

You should refer to distribution analysis in your answer.

(6)

We could firstly count each infected plant and plot them as a dot on a map. This would give us an idea of how the lesions are spreading. Should they spread in a single direction or in a line, we can assume that ~~they are~~ the infection is spreading through the wind as fungal spores. We could prove / disprove this by overlaying the wind direction on our map. Should they spread in a circle, we could assume that it spreads through the soil / physical contact. If the distribution seems random, we could assume that environmental conditions, or an animal vector are causing the lesions.

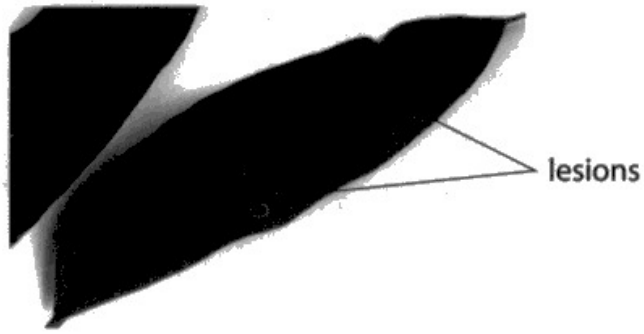
ResultsPlus
Examiner Comments

This is a Level 2 response as it contains detailed information on fieldwork. It talks about counting infected plants, mapping them, viewing their distribution patterns and overlaying the wind direction. It achieves four marks within Level 2 as it makes links to indicate that observable patterns could help provide information about the mechanism of spread for the pathogen/possible environmental cause. There is no reference to testing which prevents Level 3 from being awarded.

7 Plant growth can be affected by the environment, by pathogens, or both.

(a) A farmer found lesions on crop plants growing in one of their fields.

Figure 11 shows lesions on leaves.



(Source: © nang nang/Shutterstock)

Figure 11

*(i) Discuss how the cause of the lesions and their spread through the crops could be investigated.

You should refer to distribution analysis in your answer.

(6)

The farmer should get samples of ~~leaves~~ crop plants with and without lesions to be tested in a lab to look for pathogens that could cause the lesions ~~Alone~~
The farmer should also look at any environmental factors that could potentially cause the lesions.

ResultsPlus
Examiner Comments

This is a minimal Level 2 response. They have taken samples of the plants for fieldwork and tested them for pathogens. This is very brief for both fieldwork and testing. The reference to environmental factors that cause lesions is repeating the information from the question.

ResultsPlus
Examiner Tip

Avoid repeating information given in the introduction to the question.

Question 7 (a)(ii)

This question asked for a precaution that could be taken when digging up affected plants. The precaution is needed to prevent the spread of a possible pathogen to other crops and this alone without a named precaution was insufficient. Marks were most commonly awarded for wearing gloves, for ensuring that all the roots of the plant were removed and making sure there was no contact between affected and unaffected plants or soil.

(ii) The farmer decides to dig up the affected crop plants.

Give **one** precaution the farmer should take when digging up the affected crop plants.

(1)

wear protective gear

ResultsPlus
Examiner Comments

Protective gear is very general and not a clear precaution specific to the question. Wearing gloves is specific and was acceptable.

(ii) The farmer decides to dig up the affected crop plants.

Give **one** precaution the farmer should take when digging up the affected crop plants.

(1)

Not to leave any roots of the affected plant behind as it could regrow / infect others

ResultsPlus
Examiner Comments

This was commonly seen and a good precaution that would need to be taken.

Question 7 (b)

For this question candidates needed to apply their knowledge on the process of translation. Lower ability candidates found this challenging, often only being able to gain a mark for reference to the process happening at ribosomes but many candidates showed detailed knowledge referring to codons being complementary to the anticodons on tRNA which have an amino acid attached. Some high level responses also referred to polypeptide chains forming and folding to form the viral proteins. No marks were awarded for details of the lytic lifecycle as this did not answer the question.

(b) The genetic material of some plant viruses is single-stranded RNA.

The RNA is copied by the infected host cell and acts as a mRNA molecule.

Describe how protein synthesis makes viral proteins from this mRNA.

(4)

This mRNA will [redacted] attach to the ribosome to undergo translation, after transcription. The ribosome reads the viral mRNA's codons and tRNA brings amino acids ~~and~~ and complementary anti-codons to match. The amino acids join together to make a chain, called a polypeptide chain. This chain then forms together to make protein, coded by the viral mRNA, to make viral proteins.

ResultsPlus
Examiner Comments

This is a detailed and accurate response which scored four marks. They show a clear understanding of the role of tRNA in translation leading to the formation of a polypeptide chain.

(b) The genetic material of some plant viruses is single-stranded RNA.

The RNA is copied by the infected host cell and acts as a mRNA molecule.

Describe how protein synthesis makes viral proteins from this mRNA.

(4)

The mRNA binds a ribosome in the host cell to carry out the translation phase. The mRNA binds to that ribosome. The ribosome then sends transfer RNA (tRNA) to bring the amino acids - building blocks of proteins - to the ribosome. Complementary base pairing between the tRNA's anticodons and the mRNA's codons (base triplets) ensures the amino acids are brought in the correct order. The ribosome then joins these amino acids together to form a polypeptide (protein).

ResultsPlus
Examiner Comments

This is a second example of a detailed and accurate response. There is clear understanding of codons and anticodons and how a polypeptide chain is formed. Four marks were awarded although they have addressed more than four marking points from the mark scheme.

(b) The genetic material of some plant viruses is single-stranded RNA.

The RNA is copied by the infected host cell and acts as a mRNA molecule.

Describe how protein synthesis makes viral proteins from this mRNA.

(4)

The mRNA bonds to a ribosome in the cytoplasm. The ribosome reads the codons and then finds a matching tRNA which has the correspondant anti-codons and amino acid. Once all of the amino acids have been formed the ribosome folds up the amino acids in a specific shape to make the specific viral protein

ResultsPlus
Examiner Comments

This scored three marks as there is some confusion and lack of accuracy. The marks were given for mRNA bonds to the ribosome, that tRNA has corresponding anticodons and that tRNA contains the amino acids. Folds the amino acids is not sufficient for a chain of amino acids or polypeptide folds, it also gives the idea that amino acids are formed rather than transferred.

Question 8 (a)(i)

Candidates were asked to calculate the volume of a cube and include the unit. Most were able to calculate volume but many candidates did not include the unit or incorrectly gave this as mm^2, cm^2 or cm^3. This highlights the importance of reading the questions carefully.

8 A student investigated the movement of water in potatoes.

The student used three identical cubes of potato.

The size of a cube is shown in Figure 12.

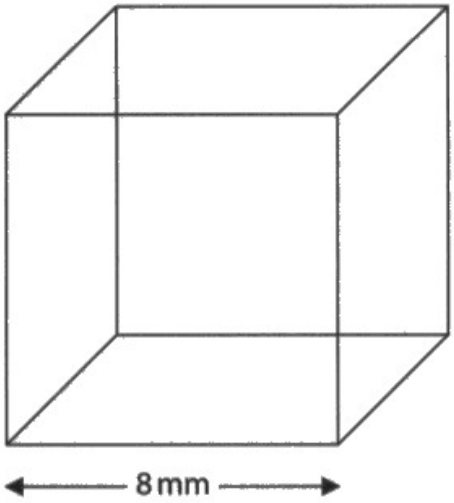


Figure 12

(a) (i) Calculate the volume of this cube.

Include the units in your answer.

(2)

$8 \times 8 \times 8 = 512\ mm^3$

$512\ mm^3$

ResultsPlus
Examiner Comments

This has full marks for the correct calculation and the correct unit.

8 A student investigated the movement of water in potatoes.

The student used three identical cubes of potato.

The size of a cube is shown in Figure 12.

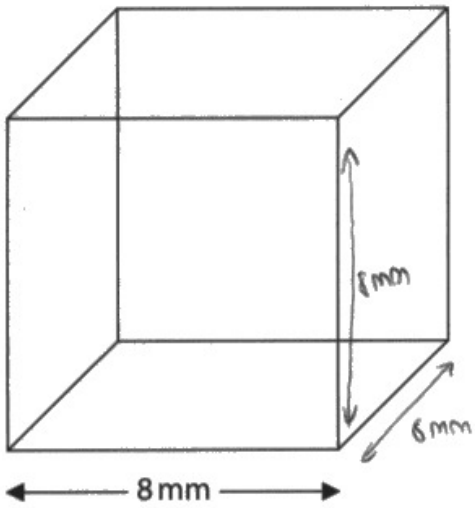


Figure 12

(a) (i) Calculate the volume of this cube.

Include the units in your answer.

(2)

$= 8mm \times 8mm \times 8mm$

$= 512mm^2$

$512mm^2$

ResultsPlus
Examiner Comments

This has the incorrect unit but scored one mark for the calculation.

8 A student investigated the movement of water in potatoes.

The student used three identical cubes of potato.

The size of a cube is shown in Figure 12.

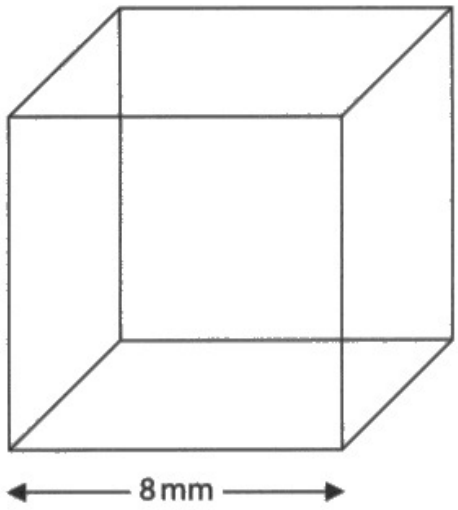


Figure 12

(a) (i) Calculate the volume of this cube.

Include the units in your answer.

(2)

8 × 8 × 8 = 512

512.

ResultsPlus
Examiner Comments

This has one mark for the calculation but does not give the unit which was requested in the question.

ResultsPlus
Examiner Tip

Always read the maths questions carefully to identify how your final answer should be given.

Question 8 (a)(ii)

This was a practical skills question which asked how the accuracy of a measurement could be improved. Accuracy is about how close the measured value is to the true value. The mark was awarded for drying the cube before its mass was measured or measuring using a balance that measured to a 1000th gram. Some candidates gave the idea of using a balance or repeating the measurement, which does not address accuracy.

One cube was placed in water and each of the other two cubes were placed in solutions with different concentrations of salt.

The cubes were left for 20 minutes.

Figure 13 shows the student's results.

	starting mass in grams	final mass in grams
water	0.95	1.08
dilute salt solution	0.95	0.98
concentrated salt solution	0.94	0.88

Figure 13

(ii) Give **one** way the student could ensure the measurement of the mass of the cubes is accurate.

(1)

Dry the wet cubes with a tissue.

This will ensure an accurate measurement of the final mass and was awarded the mark.

One cube was placed in water and each of the other two cubes were placed in solutions with different concentrations of salt.

The cubes were left for 20 minutes.

Figure 13 shows the student's results.

	starting mass in grams	final mass in grams
water	0.95	1.08
dilute salt solution	0.95	0.98
concentrated salt solution	0.94	0.88

Figure 13

(ii) Give **one** way the student could ensure the measurement of the mass of the cubes is accurate.

(1)

Using weighing scales

ResultsPlus
Examiner Comments

This is not sufficient as weighing scales have already been used.

One cube was placed in water and each of the other two cubes were placed in solutions with different concentrations of salt.

The cubes were left for 20 minutes.

Figure 13 shows the student's results.

	starting mass in grams	final mass in grams
water	0.95	1.08
dilute salt solution	0.95	0.98
concentrated salt solution	0.94	0.88

+0.13 +0.03 -0.06

osmosis into cube

- osmosis into cube

osmosis out of cube

Figure 13

(ii) Give **one** way the student could ensure the measurement of the mass of the cubes is accurate.

(1)

by repeating the measurment and calculating average from the repeats.

ResultsPlus
Examiner Comments

This was a common incorrect response. It does not address the idea of improving accuracy.

Question 8 (a)(iii)

Candidates were asked to explain the mass change of a cube placed in concentrated salt water. This was well answered showing a good understanding of osmosis. Marks were awarded for the decrease in mass, water leaving the cube by osmosis, across a partially permeable membrane and a description of the gradient. Some candidates referred to water potential gradient although a high water concentration to a low water concentration was credited. When making a comparison between the concentrations of two solutions candidates should make sure they use comparative terms such as lower/higher.

(iii) Explain the mass change in the cube in the concentrated salt solution.

(3)

Through osmosis some water went from the high concentrated salt solution to the low concentrated solution in the cells of the potatoe.

ResultsPlus
Examiner Comments

This gained a mark for osmosis as it was clear that it was water moving. The direction of water movement is incorrect and no further marks were given.

(iii) Explain the mass change in the cube in the concentrated salt solution.

(3)

The water moved from a high water concentration to a low water concentration through a semi-permeable membrane. This is why the cube has decreased in mass as it has lost water via osmosis.

ResultsPlus
Examiner Comments

This detailed response included the comparison of the water levels, a semi-permeable membrane as well as mass loss and water loss by osmosis. It was awarded full marks.

Question 8 (a)(iv)

Practical questions which require candidates to suggest improvements to methods have challenged candidates in the past. The question asked how the method used could determine the concentration of salt that led to no change in mass. A mark was awarded for repeating the investigation with more concentrations of salt solution which most candidates accessed. Some candidates gave the idea that other variables needed to be controlled and higher level responses recognised that the concentrations of salt should be between the dilute and the concentrated, with some referring to plotting a graph to predict the isotonic concentration point.

(iv) The student wanted to find the concentration of salt solution where the potato cube did not change mass.

Describe how the student could modify this investigation to find this concentration.

(3)

They should keep the surface area and mass of the potato the same but repeat the experiment with a larger range of salt concentration solutions. Specifically between the dilute salt solution and concentrated (where the correct concentration should lie). ✱ The mass of the potato should stay the same because the concentration of water in the potato is equal to the concentration of water in the salt solution.

ResultsPlus
Examiner Comments

Surface area / mass of potato is the additional guidance mark for controlling variables. Repeating the experiment with a larger range of salt solution is equivalent to it being repeated at different salt concentrations and they also recognised that the concentrations should be between the dilute and concentrated salt solution. Full marks awarded.

(iv) The student wanted to find the concentration of salt solution where the potato cube did not change mass.

Describe how the student could modify this investigation to find this concentration.

(3)

The student could repeat the experiment with different concentrations ~~osmosis~~ and plot points on a graph. When the change in mass is zero, this concentration is the isotonic point.

ResultsPlus
Examiner Comments

This scored one mark for different concentrations. As the question is in the context of salt solutions they did not need to state salt concentrations. They also have the idea of plotting a graph to find the concentration where no mass change occurs which is sufficient for a second mark. They didn't control variables or recognise that the concentrations should be between the dilute and the concentrated salt solutions.

Question 8 (b)

This question was challenging with many candidates not recognising that they needed to apply knowledge of plant cell structures to the practical situation. The marks were awarded for the idea of the cell wall providing structure or strength, the idea that the cells could become turgid or that they had a vacuole which can store water. Many incorrect responses referred to the partially permeable membrane allowing the movement of water into and out of the cells which prevent bursting. Application questions are more challenging than direct recall of knowledge.

(b) Explain why potato cells do not burst when placed in water.

(2)

They have partially permeable membranes so the water could just leave the cell if there was too much water instead of bursting.

The concentration of water in and out of the cells should be equal not the potato more than the water. **(Total for Question 8 = 11 marks)**

ResultsPlus
Examiner Comments

This was a common error seen across a number of candidates who linked the movement of water freely across a partially permeable membrane as a reason for the cells not bursting and did not refer to the cell wall.

(b) Explain why potato cells do not burst when placed in water.

(2)

There is not so much water that it bursts. The cells are able to hold this much water and store it inside the vacuole.

ResultsPlus
Examiner Comments

Water is stored in the vacuole was acceptable for one mark. There was no link to cell wall for any further marks.

(b) Explain why potato cells do not burst when placed in water.

(2)

osmosis is a passive process, meaning that once ~~it~~ particles reach no net movement, it stops. Also, ~~cells~~ potato cells have rigid cell walls which prevent them from bursting

ResultsPlus
Examiner Comments

Rigid cell walls was worth two marks. The links to osmosis and net movement were ignored.

Question 9 (a)

Most candidates were able to give two factors, other than genetics, that influence a person's mass with diet and exercise being the most frequent responses. Some linked the fact that these were lifestyle or environmental factors. Responses relating to age, sex or height were not credited as they do not address the idea of influence.

9 (a) A person's mass is partially influenced by the alleles they inherit from their parents.

Give **two** other factors that can influence a person's mass.

(2)

Their diet and frequency of exercising.

ResultsPlus
Examiner Comments

This gained full marks for two factors that influence a person's mass. These were the most commonly seen responses.

9 (a) A person's mass is partially influenced by the alleles they inherit from their parents.

Give **two** other factors that can influence a person's mass.

(2)

Environmental, for example the types of food you eat and how much exercise you do.

ResultsPlus
Examiner Comments

This has three possible factors. The idea of environmental influence was an independent marking point, this also has the idea of diet and exercise.

Question 9 (b)

Candidates were required to interpret the information in the table and comment on the data and health risks to the patient. Most candidates recognised the person was overweight with a healthy waist : hip ratio but many candidates linked the overweight idea to an increased risk of cardiovascular disease rather than recognising that the two measurements could be used to suggest the mass was due to muscle or at least that the fat was not around vital organs in the abdomen. Many candidates misinterpreted the waist : hip ratio, indicating that they were either abdominally obese or nearly abdominally obese. A significant number of responses did not appreciate that the units of alcohol drunk were per day and the guidance was for a week. Other candidates calculated the weekly intake to be between 21 and 28 units and linked this to liver damage. Although some candidates linked lack of smoking to being healthy, they didn't gain the mark unless it was linked to a low risk of a disease associated with smoking.

(b) Figure 14 shows the data obtained from a patient by a doctor doing a health check.

The guidance used by the doctor is also listed in Figure 14.

measurement	data	guidance
BMI	28	18–25 healthy 26–30 overweight 30+ obese
waist : hip ratio	0.85	<0.9 healthy >0.9 abdominal obesity
alcohol units	3–4 units per day	<14 units per week
number of cigarettes smoked	0	do not smoke or vape

Figure 14

Comment on the data and the health risks to this patient.

(4)

- one patient is overweight
- one patient has a healthy waist : hip ratio
- one patient drink too much alcohol but does not smoke.
- one patient is at risk of liver failure and obesity due to overdrinking and likely lifestyle choices, and is close to having abdominal obesity.

ResultsPlus
Examiner Comments

This scored three marks. The patient is overweight is sufficient for the interpretation of BMI. A healthy waist : hip ratio is a second mark. They have linked too much alcohol with a risk of liver failure but do not smoke was not sufficient as it wasn't linked to a decreased risk of a specific disease.

(b) Figure 14 shows the data obtained from a patient by a doctor doing a health check.

The guidance used by the doctor is also listed in Figure 14.

measurement	data	guidance
BMI	28	18–25 healthy 26–30 overweight 30+ obese
waist : hip ratio	0.85	<0.9 healthy >0.9 abdominal obesity
alcohol units	3–4 units per day	<14 units per week
number of cigarettes smoked	0	do not smoke or vape

Figure 14

Comment on the data and the health risks to this patient.

(4)

The patient has a BMI of 28 which puts the patient in the overweight category. This could be due to extra cholesterol in the patients body which could lead to a risk of heart cardiovascular disease and attacks due to fatty deposits building up in coronary arteries. However the person has a waist : hip ratio of 0.85 putting them in the healthy category. Therefore their high BMI could be due to more muscle rather than cholestrol meaning there is no such a high risk of cardiovascular disease. The patient drinks 3-4 alcohol units a day which is a lot less than the guidance meaning he only has a low chance or no chance at getting liver disease. Lastly he doesn't smoke or vape as he has 0 cigarettes smoked meaning their are no health risks associated to smoking that can affect him.

ResultsPlus
Examiner Comments

This response is worth three marks with overweight and healthy waist : hip ratio linked to muscle. They incorrectly judge alcohol intake to be lower than recommended and did not say what the health risks linked to smoking are. These marking points are targeted at higher grades and therefore required more detail.

ResultsPlus
Examiner Tip

Make sure you read the information given in tables carefully.

(b) Figure 14 shows the data obtained from a patient by a doctor doing a health check.

The guidance used by the doctor is also listed in Figure 14.

measurement	data	guidance
BMI	28	18–25 healthy 26–30 overweight 30+ obese
waist : hip ratio	0.85	<0.9 healthy >0.9 abdominal obesity
alcohol units	3–4 units per day	<14 units per week
number of cigarettes smoked	0	do not smoke or vape

Figure 14

Comment on the data and the health risks to this patient.

(4)

The patient is not at a high risk of lung cancer as they do not smoke. ~~and they are not at~~ a If they drink an average of 3-4 units of alchol per day on average in a week they drink 24.5 units of alchol a week far more than recommended. Alchol is a toxin this could negatively effect the liver and put them at risk of liver failure. Their BMI shows they are overweight long term this could lead to high blood pressure which increases risk of a heart attack. Their waist: hip ratio however shows they are healthy but as just as the patient may develop abdominal obesity in the future.

ResultsPlus
Examiner Comments

This response had four marks for the link between smoking and lung cancer, the link between excess alcohol to liver damage/liver failure, overweight and healthy waist : hip ratio. References to cardiovascular disease for weight were ignored as this cannot be determined from the information presented.

Question 9 (c)

The second extended open-response question asked for a description of the structure and function of a reflex arc. The level of detail of the pathway taken by the electrical impulse was used to determine which level a response was given, with a linkage to the function of the reflex arc enabling the top of the mark band to be credited. Candidates of all abilities were able to access the question, with many making clear linkages between the components of a reflex arc, accessing Level 2 or Level 3. In Level 3 the function of the reflex arc needed to link the quick response to protection from danger to gain full marks.

*(c) The doctor also tested the reaction time of the patient.

Describe the structure and function of a reflex arc.

(6)

* A reflex is an automatic, involuntary response to protect the ~~body~~ body from harm.
When a stimulus is detected ~~the sensory neurones transport~~ it is then ~~to~~ turned into an electrical impulse which ~~is~~ then travels along the sensory ~~to~~ neurone to the central nervous system (CNS) to the relay neurone which carries it from (which carries it to) the CNS to the motor neurone ~~to~~ to the effectors which then triggers a physical response. ~~from the muscles~~
The motor neurone ~~is~~ contains axons which are insulated by the myelin sheath which causes the impulses to travel quicker as the electrical impulse has to travel a long distance ~~from~~ to the brain. All the neurones also contain dendrites which carry impulses to the cell body and axons which carry them away from the cell body.
When the ~~neurones~~ neurotransmitters travel between neurones it must diffuse across the synapse and bind to receptors on the post synaptic membrane and then ~~connect~~ to the next neurone. This repeats. This happens ~~many~~ throughout the reflex arc.

(Total for Question 9 = 12 marks)

ResultsPlus
Examiner Comments

This is a good Level 3 response for the reflex arc worth six marks. As some sensory neurones act as receptors these were not required for a complete reflex arc. They also have the function of a reflex arc with protection and quick response.

*(c) The doctor also tested the reaction time of the patient.

Describe the structure and function of a reflex arc.

(6)

Structure :

- receptor organ → ~~sens~~ receptor cell → sensory neurones → relay neurones → motor neurones → muscle

- Synapses between ~~neuron~~ neurones ~~neurones~~ and space connect to organs. Neurone transmitter ~~cross~~ trigger new impulse in next neurone

Function :

- quick reaction without thinking / process by brain

- protect body from harm

ResultsPlus
Examiner Comments

This is a Level 3 response worth six marks. The structure of the reflex arc is correct, a flow diagram is sufficient detail as it shows the direction of travel and the neurones involved. This is the top of Level 3 as it refers to protection from danger and a rapid response.

ResultsPlus
Examiner Tip

Sometimes there are better ways to present answers than a full paragraph. Other methods including flow diagrams, bullet points, labelled diagrams and tables can be used effectively to answer questions.

*(c) The doctor also tested the reaction time of the patient.

Describe the structure and function of a reflex arc.

(6)

The function of a reflexare is to cause reflexes to act quickly.
An electrical impulse is transmitted as the stimulus is ~~dated~~ detected by receptors for example ~~in the~~ skin receptors. These receptors send an electrical impulse to the sensory neuron which then transmits and electrical impulse to the CNS. the CNS then sends information to the motor neuron which sends an electrical impulse and information to the effector. the effector then produces a response for example a muscle contraction.

ResultsPlus
Examiner Comments

This was a Level 3 response but worth five marks. The structure of the reflex arc does not include a relay neurone but because they have referred to the CNS the Level 3 can still be awarded. They must include a sensory and motor neurone with either a relay neurone / brain / CNS / spinal cord / interneuron in the correct order. This response only referred to the function of a quick response and didn't mention the idea that it is a response to danger, so scored five marks overall.

*(c) The doctor also tested the reaction time of the patient.

Describe the structure and function of a reflex arc.

(6)

the reflex arc is an automatic response to a change in the environment. it happens without thinking as it would take too long.

structure

when you go near a stimulus, your receptors detect that, sending a signal to your sensory neurone. this would ~~then~~ then send a signal to your CNS, coordinating an electrical impulse between the motor and relay neurone, responding to the stimulus.

ResultsPlus
Examiner Comments

This was Level 2 and given four marks. They make a link between receptor – sensory neurone or sensory neurone and CNS. However, it was not clear for the order of the motor neurone and relay neurone so Level 3 was not awarded. The top of the level is given for the idea of quick for 'happens without thinking as it would take too long'.

Question 10 (a)(i)

A number of candidates gave incorrect responses to this question by attempting to give a genotype rather than a phenotype with heterozygous recessive the most common incorrect response. Some candidates suggested that the person was a carrier but higher ability candidates, who often went on to get the Punnett square correct, recognised the person was affected.

10 (a) Haemophilia is a sex-linked genetic disorder caused by a recessive allele on the X chromosome.

(i) Describe the phenotype of a male with the genotype X^hY.

(1)

heterozygous recessive

ResultsPlus
Examiner Comments

This is an attempt at a genotype and not a phenotype.

10 (a) Haemophilia is a sex-linked genetic disorder caused by a recessive allele on the X chromosome.

(i) Describe the phenotype of a male with the genotype X^hY.

(1)

they have haemophilia

ResultsPlus
Examiner Comments

This is the correct phenotype for someone with X^hY, they have one allele which is the recessive copy and are therefore affected.

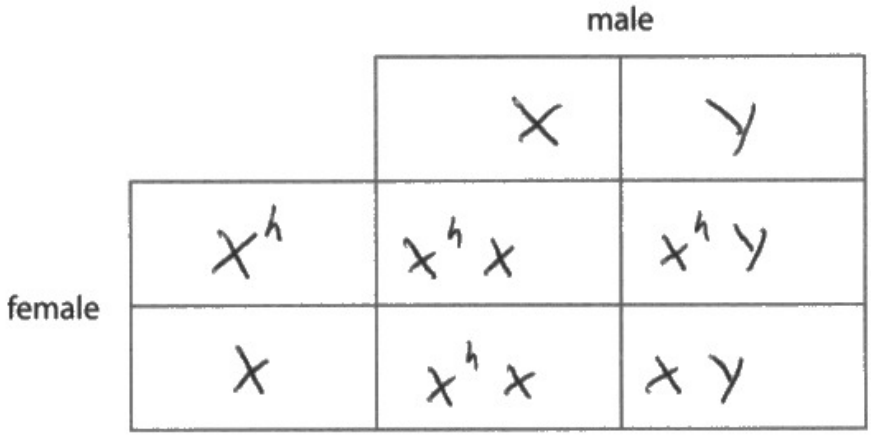
Question 10 (a)(ii)

This question challenged many candidates with some not including the sex chromosomes on the Punnett square which does not show the inheritance of haemophilia, other candidates included alleles on the Y chromosome or only putting an h allele on one X chromosome. Higher ability candidates were able to gain full marks for completing the Punnett square with the correct female and male parental genotypes.

(ii) Complete the Punnett square to show the genotypes of a male who is not affected by haemophilia, a female who is a carrier of the haemophilia allele and their possible offspring.

Use the letters H and h for the alleles.

(3)



ResultsPlus
Examiner Comments

This scored zero as none of the genotypes are correct. The female, male and offspring all have alleles missing from the X chromosomes. No error carried forward was applied as the parents do not show a genotype.

(ii) Complete the Punnett square to show the genotypes of a male who is not affected by haemophilia, a female who is a carrier of the haemophilia allele and their possible offspring.

Use the letters H and h for the alleles.

(3)

		male	
		X^H	Y^H
female	X^H	$X^H X^H$	$X^H Y^h$
	X^h	$X^H X^h$	$X^h Y^H$

ResultsPlus
Examiner Comments

The female genotype was correct for one mark. The male and the offspring were incorrect as an allele is shown on the Y chromosomes.

(ii) Complete the Punnett square to show the genotypes of a male who is not affected by haemophilia, a female who is a carrier of the haemophilia allele and their possible offspring.

Use the letters H and h for the alleles.

(3)

		male	
		X^h	Y
female	X^h	X^hX^h	X^hY
	X^H	X^hX^H	X^HY

ResultsPlus
Examiner Comments

The female genotype was correct for one mark, the male was incorrect. However using their incorrect genotype for the male they have completed the Punnett square correctly and gain a second mark for the offspring because an error carried forward was applied.

(ii) Complete the Punnett square to show the genotypes of a male who is not affected by haemophilia, a female who is a carrier of the haemophilia allele and their possible offspring.

Use the letters H and h for the alleles. (3)

h = affected
H = ~~not affected~~

male

female	X^H	Y
X^H	$X^H X^H$	$X^H Y$
X^h	$X^H X^h$	$X^h Y$

ResultsPlus
Examiner Comments

This shows the correct parental genotypes and offspring genotypes for three marks.

Question 10 (b)(i)

Candidates needed their knowledge of transcription to answer this question, which asked how a mutation in the non-coding region could result in less protein being produced. It required knowledge on reduced binding of RNA polymerase resulting in less mRNA production or less transcription. This was a question where some candidates repeated the information in the question and only gained one mark for reduced binding of RNA polymerase to the non-coding region resulting in less protein. Some candidates recognised the role of RNA polymerase but only stated that it affected binding, rather than how. Many candidates gave responses related to mutations in the coding region changing the amino acid sequence and so did not gain credit.

(b) Some genetic disorders occur because the body does not produce enough of a protein.

(i) Describe how a mutation in the non-coding region of a gene can lead to the production of less protein.

(2)

the arrangement of bases in the genes will be altered, this means that during translation, a different amino acid will be produced when coding for proteins, this will change the sequence of amino acids and will fold incorrectly producing the wrong protein.

ResultsPlus
Examiner Comments

This does not answer the question as it is about a mutation in the coding region. This was a common error seen across the entry.

(b) Some genetic disorders occur because the body does not produce enough of a protein.

(i) Describe how a mutation in the non-coding region of a gene can lead to the production of less protein.

(2)

could mean that the RNA polymeran cannot bind to the template strand which means a protein cannot be transcribed at all.

ResultsPlus
Examiner Comments

The RNA polymerase cannot bind is one mark. A protein is not transcribed so this mark was not awarded.

(b) Some genetic disorders occur because the body does not produce enough of a protein.

(i) Describe how a mutation in the non-coding region of a gene can lead to the production of less protein.

(2)

A mutation on the non-coding region of DNA means that there is less transcription and less DNA is replicated. This means less DNA can be reproduced or made during protein synthesis.

ResultsPlus
Examiner Comments

This response refers to less transcription for one mark but there is no reference to RNA polymerase not binding.

(b) Some genetic disorders occur because the body does not produce enough of a protein.

(i) Describe how a mutation in the non-coding region of a gene can lead to the production of less protein.

(2)

A mutation in the non-coding region of a gene may affect, in a bad way, the RNA polymerase ability to bind to it so less mRNA is transcribed and so less will be translated which leads to the production of less proteins.

ResultsPlus
Examiner Comments

Affecting the binding of RNA polymerase would not be enough but this candidate has clarified that this would be in a bad way so the mark was given. Less mRNA is transcribed led to them being awarded two marks in total.

Question 10 (c)

Some candidates found this question on the process of pregnancy testing using monoclonal antibodies challenging, although many still gained credit for a hormone being present in urine that the monoclonal antibodies bound to. Lower ability candidates found it hard to extend their response beyond this. There was no credit for describing how monoclonal antibodies are made as this was not the focus of the question. Higher ability candidates gave detailed descriptions linking the hormone binding to the monoclonal antibodies with blue beads attached and that these move up the strip binding to immobilised antibodies in the test window.

(c) Monoclonal antibodies can be used in the diagnosis of genetic disorders and pregnancy testing.

HCG hormones bind to urine

Describe how a pregnancy test uses monoclonal antibodies to show that a woman is pregnant.

(4)

pregnancy ~~use~~ tests use monoclonal anti bodies to bind to the HCG hormone in the ~~person~~ womans urine in order for the beads of colour (red lines) to appear to represent if she is pregnant or not.

ResultsPlus
Examiner Comments

This has two marks for the antibodies binding to hCG which is in the woman's urine. It is not clear that the beads of colour are attached to the monoclonal antibodies or what happens after the antibodies bind to the hCG so no further marks were awarded.

(c) Monoclonal antibodies can be used in the diagnosis of genetic disorders and pregnancy testing.

Describe how a pregnancy test uses monoclonal antibodies to show that a woman is pregnant.

(4)

Firstly, the women must urinate ~~in~~ on a strip of paper, if she is pregnant, a specific hormone will be present. This hormone would stick to the antibodies located on the strip which are attached to blue beads. If the hormones are present on the antibodies, the blue beads will stick to the paper, leaving a blue line indicating the woman is pregnant. If there are no hormones stuck to the antibodies, the blue beads will wash off.

ResultsPlus
Examiner Comments

This scored three marks for the pregnancy hormone linked to urine, the hormone sticking to the antibodies and that the antibodies having blue beads attached. The response does not have an indication of binding to immobilised antibodies or moving up the strip and colour appearing in the test window.

(c) Monoclonal antibodies can be used in the diagnosis of genetic disorders and pregnancy testing.

Describe how a pregnancy test uses monoclonal antibodies to show that a woman is pregnant.

(4)

A hormone HCG is only present in a pregnant womans urine. A monoclonal antibody that attaches to antigens in that hormone is put on the part the woman urinates on and has blue beads attached to it. The same antibody is stuck on the strip so it can't move. The ~~urine~~ ~~tactics~~ hormone binds to the antibody and is carried along by the urine. This attaches to the stuck down antibodies, and a blue line will appear. If she is not pregnant, the beads will not stick to the strip and only the control line will form.

ResultsPlus
Examiner Comments

This detailed response shows all four marking points and a clear understanding of how a pregnancy test with monoclonal antibodies works.

Paper Summary

Based on their performance on this paper, candidates should:

- Ensure they answer the actual question in the paper. Written responses to a number of questions indicated that candidates used past papers as part of their revision process which is commendable but care must be taken to ensure that candidates answer the actual question in the paper, as although the knowledge may be similar the question is rarely identical.
- Recognise that the word 'explain' means additional scientific information is needed that is linked to the answer given. They should also understand that when they are required to make comparisons between two sets of data or two concepts, the language used in responses should be comparative – 'greater', 'faster', 'quicker' etc. When comparing two sets of apparatus ensure sufficiently different responses are given to match the number of marks and avoid just stating the reverse argument.
- Read the information given in the introduction to the question but avoid repeating it in the answer as it will not gain credit. Candidates should also read mathematical questions carefully to note whether an answer is required in standard form, to a specified number of significant figures or requires a unit to be included. They should ensure they consistently apply rules for rounding up numerical answers and understand recurring numbers.
- Ensure that methods for core practicals are understood, including the differences, accuracy and improvements to methods as well as controls and control variables. Be prepared to apply your knowledge of practical activities to unfamiliar practical investigations.
- Make sure that key scientific terms from the specification are understood including pathogen, diploid, haploid, genotype and phenotype. When completing Punnett squares for sex-linked inheritance include the sex chromosomes as well as alleles on all X chromosomes.
- Always show the mathematical workings when doing calculations as a mark can be awarded for errors carried forward. Check the number of marks given for the question and ensure that they have included enough facts to match the marks awarded.
- Consider the context of the question to ensure they apply their scientific knowledge to the situation they are being asked about.

Grade boundaries

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

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

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