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Examiners' Report
June 2025

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 eighth assessment of the GCSE (9-1) which takes place in May each year. 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, in questions that overlapped with the foundation tier, candidates were required to respond to questions that tested their knowledge and understanding of communicable and non-communicable diseases linked to waist to hip ratio, mitosis, the movement of substances including osmosis and diffusion and the work of Gregor Mendel on genetic crosses. Questions on the higher paper only assessed knowledge and understanding of growth percentiles, food tests for fats, human evolution and extinction, the three-domain classification system, cholera linked to the immune response, CT and PET scans, testing reaction times linked to factors affecting the speed of transmission in neurones, the inheritance of a dominant genetic disorder and the use of fertilisers. The first extended open response assessed knowledge on the production and use of monoclonal antibodies to diagnose blood clots and the second required candidates to apply their knowledge on the stages needed to extract DNA from strawberries and the structure of DNA—as such this question addressed practical knowledge. Other questions designed to assess practical skills included an understanding of calorimetry, the design of an investigation to test reaction times, as well as the identification of relevant controlled variables and the reasons why these need to be controlled. The question on tissue culture utilised knowledge from the core practical on aseptic techniques. The mathematical skills assessed in this paper related to interpretation of a growth percentile chart, a calculation of waist to hip ratio, significant figures, a calculation of the volume of a cube, a magnification calculation and the use of percentages to interpret genetic cross outcomes from Punnett squares.

There are now many past papers with mark schemes and examiner's reports available as well as practical support booklets 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 continues to improve, not just in higher ability candidates. Improvements were seen in responses to questions on the immune response, osmosis, magnification calculations and the analysis of data from a graph. Most candidates were able to access both extended writing responses, although the quality of responses was greater for the extraction and structure of DNA than monoclonal antibodies. The responses to practical questions on a food test and reaction times showed a good level of understanding but candidates are still not scoring well when asked to suggest

improvements to investigations. The uses of CT and PET scanning is higher content and had not previously been examined to the level of detail it was assessed at this year. Candidates found it challenging to explain how and why these techniques are used. Candidates are also still illustrating the misconception that children in the 5th percentile are not growing as expected and need to ensure they can interpret percentile graphs accurately. The question relating to extinction illustrated that candidates are occasionally answering questions they expect to be asked based on previous questions and not the current question posed, with many giving answers related to evolution and not extinction. Within this topic candidates successfully described changes that have occurred during human evolution and the uses of stone tools. The question on eukaryotes and prokaryotes linked to the three-domain system proved challenging for candidates to gain full marks, with many limiting their knowledge to the presence or absence of a nucleus. Candidates demonstrated a good understanding of tissue culture and the inheritance of dominant genetic conditions in both the four mark questions on the paper.

There was an improvement in the level of detail given in answers to practical questions linked to planning an investigation. It is clear that many candidates had completed the practical to extract DNA from cells, used aseptic techniques in tissue culture practical work and had tested reaction times using a ruler. In general, maths questions showed a good level of understanding, although some candidates did not give answers to the correct order of magnitude when calculating the magnification used and some candidates did not give the waist to hip ratio to the number of significant figures requested in the question.

Question 1(a)ii

This question required candidates to identify that at four years old and six years old the boy was on the 5th percentile for growth. From this they could then conclude that his growth was as expected or normal. Most candidates identified that the boy was on the 5th percentile but did not always interpret this as normal growth and stated that he was short for his age. A number of candidates illustrated the misconception that children on the 5th percentile are not growing normally.

(ii) The height of a 4-year-old boy was 94 cm. 5th percentile
Two years later, his height was 106 cm. 6 yrs 5th

Using Figure 1, explain the conclusion that can be made about the growth of this child.

(2)

This child is growing at regular and healthy rate, as his growth follows the trend of the 5th percentile

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Examiner Comments

This gained full marks as the response recognises that the boy is on the 5th percentile and that growing at a healthy/normal rate was accepted.

(ii) The height of a 4-year-old boy was 94 cm.

Two years later, his height was 106 cm.

Using Figure 1, explain the conclusion that can be made about the growth of this child.

(2)

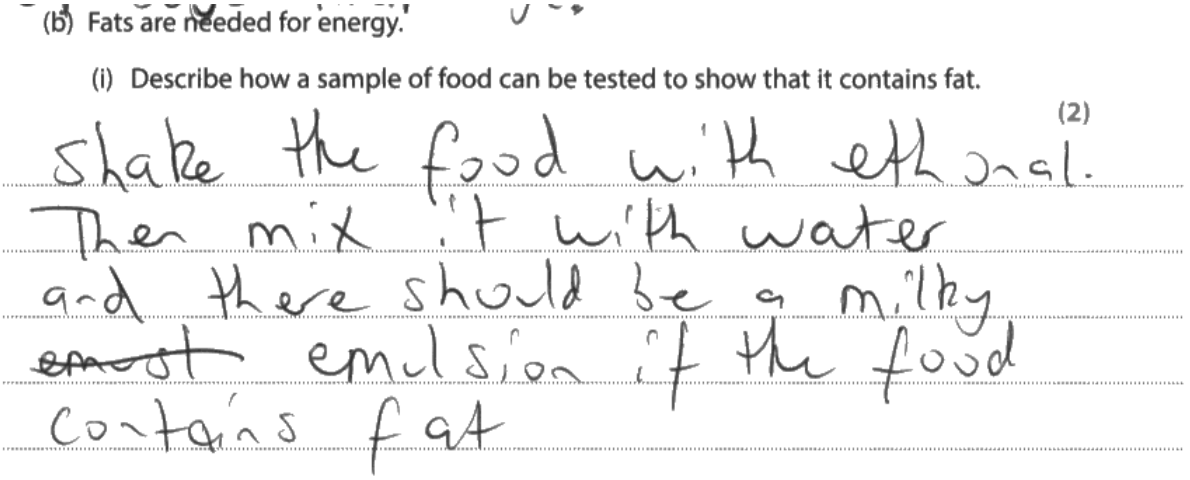
The child is in the 5th percentile he is quite small for his age.

ResultsPlus
Examiner Comments

This gained one mark for the 5th percentile but does not make a judgement about the growth of the child.

Question 1(b)i

The first marking point for this question required the identification of ethanol and water being required to test for lipids. The second marking point was for the presence of a white emulsion indicating a positive result. The idea of cloudy or a white precipitate were credited for the second marking point. Most candidates successfully described the test for lipids but some candidates only mixed the food with ethanol so did not obtain the first marking point.



(b) Fats are needed for energy.

(i) Describe how a sample of food can be tested to show that it contains fat.

(2)

Shake the food with ethanol. Then mix it with water and there should be a milky ~~emost~~ emulsion if the food contains fat

ResultsPlus
Examiner Comments

This gained full marks as the candidate has indicated the requirement for ethanol and water as well as the positive result.

(b) Fats are needed for energy.

(i) Describe how a sample of food can be tested to show that it contains fat.

(2)

Add ice cold ethanol
If it goes cloudy, fat is present

ResultsPlus
Examiner Comments

This gained one mark for the positive result. The candidate has omitted that water is also required in the test for fats.

ResultsPlus
Examiner Tip

Learn the methods for the four food tests as well as the positive and negative results which would be observed.

Question 1(c)

This question asked what calorimetry was used to measure. Marks were obtained for the idea that it measured the energy content or calories in a food and most candidates gained the mark for this question.

(c) State what calorimetry is used to measure.

(1)

Calories

ResultsPlus
Examiner Comments

Calories was accepted as it is used as a unit of measurement for energy content.

(c) State what calorimetry is used to measure.

(1)

the amount of energy stored in food.

ResultsPlus
Examiner Comments

The energy stored in the food gained the mark.

(c) State what calorimetry is used to measure.

(1)

~~release~~ calorimeter

ResultsPlus
Examiner Comments

This is the equipment and not what it is used to measure so did not gain the mark.

Question 2(a)

This question required the identification of two ways in which the spread of tuberculosis could be reduced or prevented. Most candidates gained the marks for the idea of covering the mouth or wearing a mask and isolating infected individuals. Vaccination and the idea of washing hands were less common responses and antibiotics was rarely given. The question was well answered by most candidates. Some candidates only gained one mark for two very similar ideas like covering the mouth and wearing a face mask which were the same marking point. Responses that referred to the idea of social distancing were credited but not just the term lockdown. Using PPE was not credited unless the answer referred to specific ideas related to tuberculosis.

2 (a) Tuberculosis is a disease that is spread through airborne droplets.

Give **two** ways of reducing or preventing the spread of tuberculosis.

(2)

1 By people wearing face masks.

2 By people washing their hands frequently.

ResultsPlus
Examiner Comments

This gained two marks. Face masks was a common answer given, washing hands was also creditworthy. Washing, sanitising or disinfecting surfaces or hands was credited for this marking point.

2 (a) Tuberculosis is a disease that is spread through airborne droplets.

Give **two** ways of reducing or preventing the spread of tuberculosis.

(2)

1 Cough into a tissue

2 Avoid crowds of ill people

ResultsPlus
Examiner Comments

Both of these answers would prevent the spread of TB and gained full marks.

2 (a) Tuberculosis is a disease that is spread through airborne droplets.

Give **two** ways of reducing or preventing the spread of tuberculosis.

(2)

1 isolation

2 vaccination

ResultsPlus
Examiner Comments

Although brief responses both isolation and vaccination would reduce the spread of TB so the response gained full marks.

Question 2(b)i

Candidates could gain the mark for this question by stating that liver disease is non-communicable because it cannot be spread from person to person or that it was not caused by a pathogen. The idea of it being caused by alcohol consumption was also accepted.

(b) Obesity is a risk factor for some non-communicable diseases.

(i) State why liver disease is a non-communicable disease.

(1)

Liver disease cannot be spread between people.

ResultsPlus
Examiner Comments

This gained the mark as it clearly indicates that liver disease is not spread person to person.

(b) Obesity is a risk factor for some non-communicable diseases.

(i) State why liver disease is a non-communicable disease.

(1)

because it is caused by lifestyle choices such as large consumptions of ~~alcohol~~ alcohol

ResultsPlus
Examiner Comments

Lifestyle choices was insufficient on its own but consumption of alcohol was credited as a reason why liver disease is non-communicable. The knowledge is covered in topic 5 of the specification.

(b) Obesity is a risk factor for some non-communicable diseases.

(i) State why liver disease is a non-communicable disease.

(1)

It can't be spread from person to person as it isn't caused by a pathogen.

This high level response gives both aspects of the mark scheme although only one was required for the mark.

Use key scientific terms to improve responses to questions.

Question 2(b)ii

For this question candidates were given the equation to calculate the waist to hip ratio and asked to give the answer to 2 decimal places. Most candidates successfully calculated the correct answer but not all of them correctly gave the answer to 2 decimal places.

(ii) The waist-to-hip ratio can be used to show if excess weight is a health risk.

An adult has a waist measurement of 80 cm and a hip measurement of 90 cm.

Calculate the waist-to-hip ratio for this adult, using the equation:

$$\text{waist-to-hip ratio} = \frac{\text{waist measurement}}{\text{hip measurement}}$$

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

(2)

$\frac{80}{982} = 0.8889$

waist-to-hip ratio 0.99

ResultsPlus
Examiner Comments

This response gained one mark but it was not correctly rounded to 2 decimal places.

ResultsPlus
Examiner Tip

Apply rules on rounding when giving answers to a specific number of decimal places or significant figures.

(ii) The waist-to-hip ratio can be used to show if excess weight is a health risk.

An adult has a waist measurement of 80 cm and a hip measurement of 90 cm.

Calculate the waist-to-hip ratio for this adult, using the equation:

$$\text{waist-to-hip ratio} = \frac{\text{waist measurement}}{\text{hip measurement}}$$

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

(2)

$\frac{80}{90} = 0.888\dot{} = 0.89$

waist-to-hip ratio 0.89

ResultsPlus
Examiner Comments

This response clearly shows the workings and the answer correctly given to two decimal places.

Question 2(b)iii

This question required candidates to interpret the data in figure 2. The first mark was for identifying that a waist-to-hip ratio of 0.75 equates to a low health risk. The second marking point was for justifying this interpretation. The mark was given for the idea that 0.75 is less than 0.8 or that this showed that the excess mass or fat was not around the waist or vital organs. Some candidates confused waist-to-hip ratio with BMI and some responses referred to health complications as a result of low body mass despite no information relating to mass being given in the question.

(iii) Figure 2 shows the health risk of some waist-to-hip ratios.

health risk	waist-to-hip ratios	
	males	females
low	0.95 or less	0.80 or less
medium	0.96 to 1.0	0.81 to 0.85
high	1.1 or more	0.86 or more

Figure 2

Explain the health risk for a female with a waist-to-hip ratio of 0.75.

(2)

She has a ~~low~~ low health risk as not a lot of ~~the~~ the fat percentage in her body is accumulated around her waist ~~or~~ or vital organs.

ResultsPlus
Examiner Comments

This scored both marks for the low risk to health and that the fat was not around the waist or vital organs. Weight or mass around the vital organs was also credited.

(iii) Figure 2 shows the health risk of some waist-to-hip ratios.

health risk	waist-to-hip ratios	
	males	females
low	0.95 or less	0.80 or less
medium	0.96 to 1.0	0.81 to 0.85
high	1.1 or more	0.86 or more

Figure 2

Explain the health risk for a female with a waist-to-hip ratio of 0.75.

(2)

If a female has a waist-to-hip ratio of 0.75 then she will have a low health risk as her waist-to-hip ratio is less than 0.80.

ResultsPlus
Examiner Comments

This illustrates the alternative way to gain the mark interpreting that the female had a low risk to health as 0.75 is less than 0.8.

(iii) Figure 2 shows the health risk of some waist-to-hip ratios.

health risk	waist-to-hip ratios	
	males	females
low	0.95 or less	0.80 or less
medium	0.96 to 1.0	0.81 to 0.85
high	1.1 or more	0.86 or more

Figure 2

Explain the health risk for a female with a waist-to-hip ratio of 0.75.

(2)

- waist-to-hip ratio is below the average
- could lead to serious health risks like anemia or anorexia
- lead to short term risks like fatigue and tiredness.

ResultsPlus
Examiner Comments

The question gives no information regarding the mass or BMI of the female so interpretations about other health risks cannot be made. A number of candidates lost marks for giving answers with a similar content.

Question 2(c)

Most candidates scored highly on this question recognising that cells produced by mitosis had the properties of being genetically identical or diploid. The idea that two cells were produced or that they were body cells was credited. Descriptions of diploid were also accepted. No credit was given to the uses of these cells in growth, repair or asexual reproduction. Candidates lost marks where they gave contradictory answers to one of the marking points such as haploid cells or genetically different cells.

(c) Cancer occurs when cell division by mitosis is uncontrolled.

Describe the properties of cells produced by mitosis.

(2)

Mitosis produces two genitically identical daughter cells, with a haploid nucleus

ResultsPlus
Examiner Comments

This scored one mark for two correct answers and one incorrect answer. The list rule applied to responses that gave more than two answers.

(c) Cancer occurs when cell division by mitosis is uncontrolled.

Describe the properties of cells produced by mitosis.

(2)

Mitosis produces 2 cells which are genetically identical daughter cells and have a diploid nucleus so a full set of DNA.

ResultsPlus
Examiner Comments

This response illustrates three marking points which were all correct and gained two marks. Two cells, genetically identical and diploid.

(c) Cancer occurs when cell division by mitosis is uncontrolled.

Describe the properties of cells produced by mitosis.

(2)

~~Cells produced by~~ Mitosis produces are diploid cells, it produces 2 genetically identical daughter cells, cells are used for growth and repair and/or ~~or~~ asexual reproduction.

ResultsPlus
Examiner Comments

This gains full marks hitting three marking points. There was no credit awarded for the use of the cells in growth and repair as this question asks for properties.

Question 3(a)

Candidates scored well on this question explaining that the mass of the potato would increase due to osmosis. Marks were awarded for defining the process of osmosis as well as the idea that water moved into or was absorbed by the potato. Candidates were limited to two marks when they incorrectly stated that the mass of the potato would decrease. Answers to this question indicated that candidates had used previous papers during revision and more candidates are defining key terms within their explanations.

3 (a) Figure 3 shows a beaker containing a potato cylinder in distilled water.

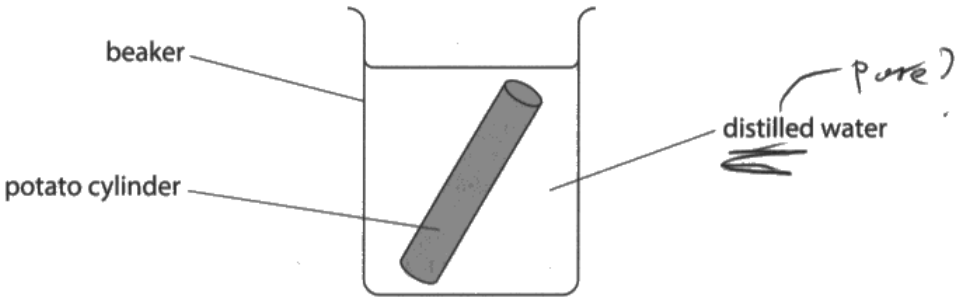


Figure 3

Explain why the mass of this potato cylinder will change when it is placed in distilled water.

(3)

The potatoe will absorb the water molecules through ~~or~~ Osmosis. Osmosis is the movement of particles through a semi-permeable membrane from a high to low concentrate,

ResultsPlus Examiner Comments

This has four marking points illustrated. The potato absorbing water through osmosis and as water is being absorbed so the marks for semi-permeable membrane and high to low concentration were awarded.

ResultsPlus Examiner Tip

Learn the definitions for the movement of substances including diffusion, osmosis and active transport.

3 (a) Figure 3 shows a beaker containing a potato cylinder in distilled water.

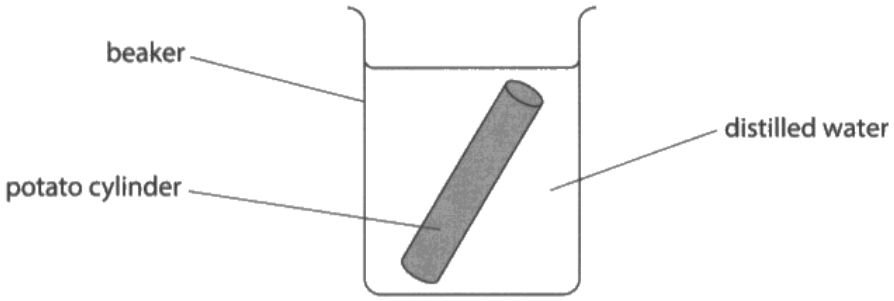


Figure 3

Explain why the mass of this potato cylinder will change when it is placed in distilled water.

(3)

• Potato is made up of plant cells - (vacuole)
• ~~Blood~~ cells absorb water via osmosis when ~~put in~~ submerged
• Vacuole in cells expands to store water
• Added water increases mass of cylinder

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Examiner Comments

This scored full marks. The cells absorb water was sufficient for the potato absorbs water. Via osmosis and increased mass were also credited.

3 (a) Figure 3 shows a beaker containing a potato cylinder in distilled water.

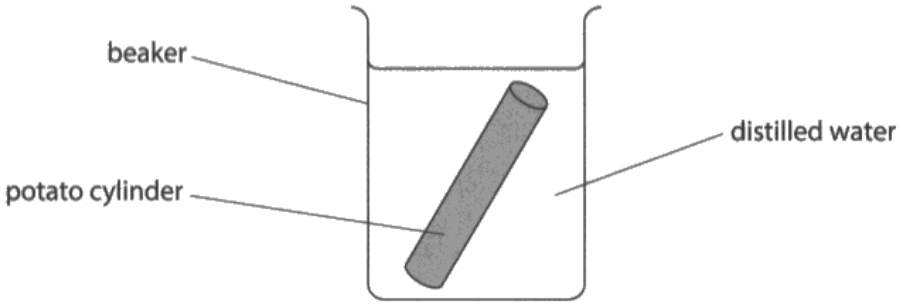

Figure 3

Explain why the mass of this potato cylinder will change when it is placed in distilled water.

(3)

• Water potential in the potatoe will diffuse
• This is osmosis the net movement of water particles from a high concentration to a low concentration
• The potato's mass will therefore change

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Examiner Comments

This scored two marks for osmosis and the description of the net movement of water. The question asked about the mass change and this response has not indicated whether mass is gained or lost.

Question 3(b)i

Most candidates scored full marks on this question, correctly calculating the volume of cube C. Most candidates calculated this by using 33. Some candidates used the surface area to volume ratio to obtain the correct answer, by dividing 54 by 2.

(b) A scientist investigated the rate of diffusion using three agar cubes of different sizes.

Each cube contained a pH indicator that changed from pink to colourless when placed in acid.

The cubes were placed in a beaker containing an acid.

Figure 4 shows some information about each cube.

cube	length of each side of cube in cm	surface area in cm^2	volume in cm^3	surface area to volume ratio	time taken for the cube to become colourless in seconds
A	1.0	6	1	6 : 1	170
B	2.0	24	8	3 : 1	260
C	3.0	54	?	2 : 1	500

Figure 4

(i) Calculate the volume of cube C.

(2)

3·0 × 3·0 × 3·0

= 27·0

27·0 cm^3

ResultsPlus
Examiner Comments

This response shows the correct answer and the decimal place is correct. They also show a correct method.

(b) A scientist investigated the rate of diffusion using three agar cubes of different sizes.

Each cube contained a pH indicator that changed from pink to colourless when placed in acid.

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A	1.0	6	1	6 : 1	170
B	2.0	24	8	3 : 1	260
C	3.0	54	?	2 : 1	500

Figure 4

(i) Calculate the volume of cube C.

(2)

18 cm^3

ResultsPlus
Examiner Comments

This has the correct answer crossed out but replaced with the incorrect calculation and no marks were awarded. The correct answer on the answer line always scores full marks even if the workings shown are incorrect.

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Examiner Tip

Only show one method for a calculation. If you get the answer incorrect examiners will not

credit correct workings if incorrect workings are also shown.

(b) A scientist investigated the rate of diffusion using three agar cubes of different sizes.

Each cube contained a pH indicator that changed from pink to colourless when placed in acid.

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A	1.0	6	1	6 : 1	170
B	2.0	24	8	3 : 1	260
C	3.0	54	?	2 : 1	500

Figure 4

(i) Calculate the volume of cube C.

(2)

Surface area x length = volume.

54 x 3.0 = 162

$\sqrt[3]{162} = 5.5$

54 ÷ 2 = 27

27 ÷ 3.0 = 9

~~5.5~~ 9 ..... cm^3

ResultsPlus
Examiner Comments

This response had calculated the correct answer of 27 but used it in an additional step. One mark was awarded. They crossed out the incorrect workings. Full marks cannot be awarded if the number on the answer line is not correct.

Question 3(b)ii

This question required candidates to explain the difference in the time taken for cubes A and B to become colourless. Most candidates scored well by recognising that cube A was quicker because it was smaller or that it had a large surface area to volume ratio. The reverse argument was also accepted. No marks were awarded for quoting times from the table or calculated differences without an indication of which was quicker or slower. References to surface area in isolation were ignored. No credit was given to the idea of a faster rate of diffusion, as the linked explanation related to diffusion distance and not rate.

(ii) Explain the difference in the times taken for cubes A and B to become colourless.

(2)

Since B has a smaller surface area to volume ration to A, the rate of diffusion of the pH indicator is slower so it takes longer for the colour to go.

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Examiner Comments

This response shows the reverse argument. Cube B has a smaller surface area to volume ratio and is the reverse of the second marking point and a longer time for the colour to go is the first marking point. The rate of diffusion was ignored as it is incorrect. The third marking point was for a shorter diffusion distance (for cube A) or reverse argument.

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Examiner Tip

For diffusion, check whether the question is examining the rate of diffusion or diffusion distance.

(ii) Explain the difference in the times taken for cubes A and B to become colourless.

(2)

Cube C takes longer to become colourless because the surface area is larger meaning more acid is needed to change the colour.

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This did not explain the difference in cube A and cube B and only referred to cube C so no marks were awarded.

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Examiner Tip

Make sure you answer the question being asked.

(ii) Explain the difference in the times taken for cubes A and B to become colourless.

(2)

difference

The time taken for A and B to become colourless is 260 - 170 = 90s this is because the ~~surface area~~ volume is greater and the surface area to volume ratio is lower

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Examiner Comments

This response scored zero. The first marking point needed to imply that A was quicker or B was slower. Just quoting times or time differences was not sufficient. It is not clear from this response which cube has the greater volume or lower SA:V so the second mark was not awarded either.

Question 4(a)ii

The mark for this question was awarded for any indication that the wrinkled pea characteristic was recessive. No marks were awarded for the idea of less dominant or not dominant. References to the round pea characteristic were ignored.

(ii) Figure 5 shows one of Mendel's experiments on the inheritance of pea shape.

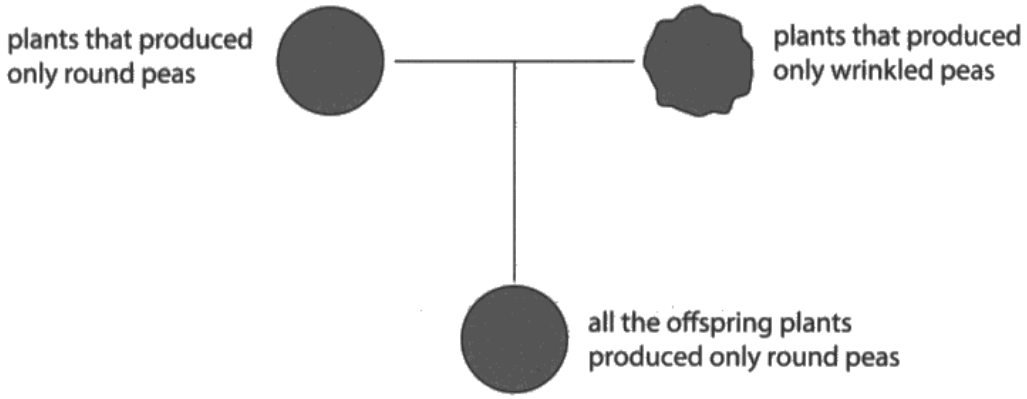

Figure 5

State the conclusion that Mendel was able to make about the wrinkled pea characteristic.

(1)

the gene that produces round peas is more dominant than the gene that produces wrinkled peas.

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This did not gain the mark as there was no link between the wrinkled peas and recessive. This implies wrinkled peas are less dominant but a reference to recessive was required.

(ii) Figure 5 shows one of Mendel's experiments on the inheritance of pea shape.

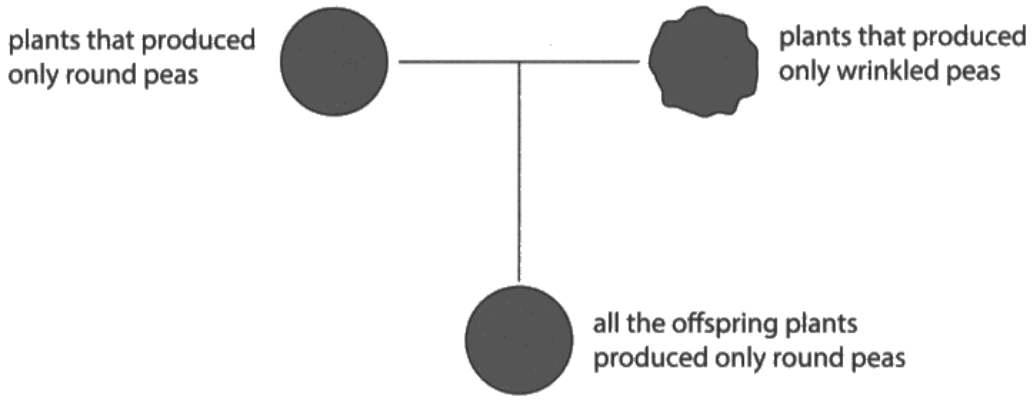

Figure 5

State the conclusion that Mendel was able to make about the wrinkled pea characteristic.

(1)

That the wrinkled pea characteristic was homozygous recessive.

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Examiner Comments

This gained the mark for the link between the wrinkled pea characteristic and recessive.

(ii) Figure 5 shows one of Mendel's experiments on the inheritance of pea shape.

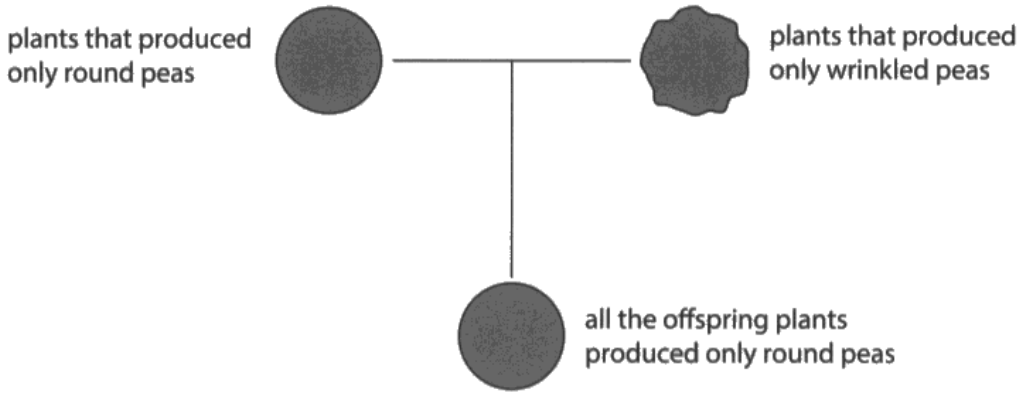


Figure 5

State the conclusion that Mendel was able to make about the wrinkled pea characteristic.

(1)

The 'hereditary units' can be dominant or recessive.

ResultsPlus
Examiner Comments

This statement is correct but does not answer the question as it does not indicate how it relates to the wrinkled pea characteristic.

Question 4(b)i

This question was high scoring with most candidates successfully completing the Punnett square and giving 25% as the probability of producing a plant with wrinkled peas. An error carried forward mark was given for the incorrect gametes leading to the correct completion of the Punnett square.

(b) A scientist crossed two pea plants that were heterozygous for pea shape.

(i) Complete the Punnett square to show the inheritance of the alleles for pea shape and the percentage probability of producing a plant with wrinkled peas.

Use the letter R for the allele for round shape.

Use the letter r for the allele for wrinkled shape.

(3)

		heterozygous	
		R	R
heterozygous	r	Rr	Rr
	r	Rr	Rr

percentage probability of producing a plant with wrinkled peas 100 %

ResultsPlus
Examiner Comments

This gained one mark. They have correctly completed a Punnett square from incorrect gametes. 100% is incorrect but had the answer line had 0% they would have gained a second mark as an error carried forward was applied to this question.

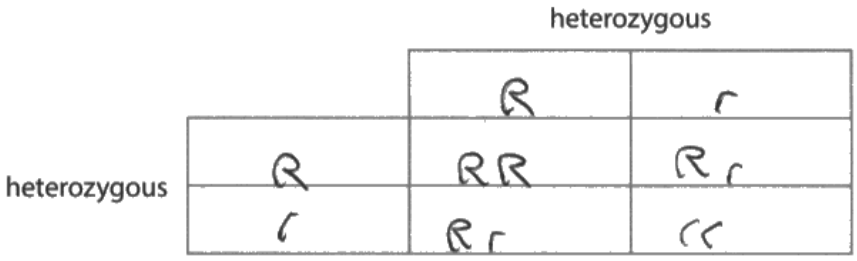
(b) A scientist crossed two pea plants that were heterozygous for pea shape.

(i) Complete the Punnett square to show the inheritance of the alleles for pea shape and the percentage probability of producing a plant with wrinkled peas.

Use the letter R for the allele for round shape.

Use the letter r for the allele for wrinkled shape.

(3)



percentage probability of producing a plant with wrinkled peas 25 %

ResultsPlus
Examiner Comments

This illustrates the correct gametes, completed Punnett square and correct percentage probability.

Question 4(b)ii

Most candidates gained two marks for this question for giving two environmental conditions which could be controlled. The most common answers given related to temperature, light or water levels. Good responses referred to the idea of using a greenhouse or the idea of eliminating insects or other plants that could lead to cross pollination.

(ii) Plants used to study inheritance are grown in controlled environmental conditions.

Suggest **two** ways of controlling these environmental conditions.

(2)

1 keep ~~light~~ the same amount of sunlight they receive the same

2 keep the volume of ~~the~~ water they receive the same.

ResultsPlus
Examiner Comments

The controlling of light and water levels were common creditworthy responses.

(ii) Plants used to study inheritance are grown in controlled environmental conditions.

Suggest **two** ways of controlling these environmental conditions.

(2)

1 ~~Greenhouse~~ Grow them in a Greenhouse

2 Use pesticides

ResultsPlus
Examiner Comments

Both aspects of this response are correct. A greenhouse is a method of controlling the environment and pesticides would prevent insects and other organisms influencing pollination or affecting the growth of plants.

Question 4(c)i

Some candidates lost marks on this question by not reading the requirements from the question. Candidates were instructed to write the words yes or no in each box. Ticks or crosses were accepted but both boxes had to be completed for a mark for that row to be awarded. It cannot be assumed a blank box indicates no.

(c) Some plants can reproduce asexually and sexually.

(i) Complete the table by writing **yes** or **no** in **each** box to show the features of asexual and sexual reproduction.

(3)

feature	asexual reproduction	sexual reproduction
produce genetically identical offspring	✓	
requires male and female gametes		✓
rapid reproductive cycle	✓	

ResultsPlus
Examiner Comments

This scored zero as they have not completed both boxes on any row.

ResultsPlus
Examiner Tip

Read the instructions given in the question carefully.

(c) Some plants can reproduce asexually and sexually.

(i) Complete the table by writing **yes** or **no** in **each** box to show the features of asexual and sexual reproduction.

(3)

feature	asexual reproduction	sexual reproduction
produce genetically identical offspring	yes	no
requires male and female gametes	no	yes
rapid reproductive cycle	yes	no

ResultsPlus
Examiner Comments

All three rows are correct in this response so maximum marks were awarded.

Question 4(c)ii

This question asked for a definition of a diploid nucleus. Answers should refer to pairs of chromosomes or a full set of chromosomes. Responses that related to human diploid nuclei were accepted, including 46 chromosomes or 23 pairs. The term diploid relates to chromosome number and answers that just referred to the amount of DNA were not credited.

(ii) A zygote with a diploid nucleus is formed by sexual reproduction.

State what is meant by a diploid nucleus.

(1)

Diploid nuclei contain 46 chromosomes (2 pairs of 23)

ResultsPlus
Examiner Comments

Diploid nuclei have pairs of chromosomes. This did gain the mark for 46 chromosomes or 23 pairs. Any number of chromosomes other than 46 was ignored but any number of pairs of chromosomes was accepted.

(ii) A zygote with a diploid nucleus is formed by sexual reproduction.

State what is meant by a diploid nucleus.

(1)

It has two times as ~~many~~ much DNA than a haploid nucleus.
double the DNA

ResultsPlus Examiner Comments

The response needed to refer to chromosomes rather than DNA or genetic material. No mark was awarded.

ResultsPlus Examiner Tip

Learn the definitions of genetic terms including allele, gene, haploid, diploid, heterozygous, homozygous, dominant, recessive, genotype and phenotype.

Question 5(a)i

The mark for this question was obtained by most candidates by correctly calculating that *Homo habilis* had lived on Earth for 900,000 years. Some candidates incorrectly calculated the time period as 1.1 million years.

Question 5(a)ii

Candidates were asked for one way in which *Homo habilis* would have used tools. The most common responses included hunting or as weapons. The idea that the tool was a sharp stone or a sharpened stone was not credited. Although rarely seen the idea that the tools could be used to date fossils was credited

(ii) Fossil evidence suggests that *Homo habilis* used tools.

State **one** use of these tools.

(1)

protection (weapons)

ResultsPlus
Examiner Comments

Protection, unqualified, was not sufficient but weapons are a use of stone tools.

(ii) Fossil evidence suggests that *Homo habilis* used tools.

State **one** use of these tools.

(1)

to kill animals

ResultsPlus
Examiner Comments

This is a description of hunting. There were many different answers to this question and they could be phrased in different ways and still gain credit.

Question 5(a)iii

Many candidates gained full marks for this question by indicating that Lucy's skull size was smaller and that she had longer arms or shorter legs. The idea that she was shorter or walked less upright was also credited. The idea that *Homo habilis* walked on two feet or was bipedal was insufficient as this applies to Lucy as well. Responses that just indicated that Lucy was more ape-like were ignored. Some candidates thought that Lucy lived more recently than _Homo habilis—most of these responses did not gain any marks

(iii) Scientists use fossil discoveries to suggest the structure of the whole body.

Lucy is a fossil of the species *Australopithecus afarensis*.

Describe how the body structure suggested for *Australopithecus afarensis* is different from the body structure suggested for *Homo habilis*.

(2)

They likely had different sized/shaped skulls and teeth. Their limbs were also likely different sizes.

ResultsPlus
Examiner Comments

Different shaped skulls or different teeth was acceptable for the second marking point. Different sized skulls is insufficient on its own as candidates should know that skull size is smaller in Lucy. Different limb sizes is also not enough; responses need to refer to arms or legs and clarify the relative length.

(iii) Scientists use fossil discoveries to suggest the structure of the whole body.

Lucy is a fossil of the species *Australopithecus afarensis*.

Describe how the body structure suggested for *Australopithecus afarensis* is different from the body structure suggested for *Homo habilis*.

(2)

Difference in skull sizes ~~and~~ as homo habilis ~~so~~ was developing a brain. Difference in posture the homo habilis is more upright

ResultsPlus
Examiner Comments

Differences in skull size was insufficient. It needed the idea of smaller for Lucy or larger for Homo habilis. Homo habilis is more upright is worth one mark but not that they walked on two feet or bipedal as this applies to Lucy as well.

ResultsPlus
Examiner Tip

When marking comparisons ensure that language used is comparative with 'er'on the end of words.

(iii) Scientists use fossil discoveries to suggest the structure of the whole body.

Lucy is a fossil of the species *Australopithecus afarensis*.

Describe how the body structure suggested for *Australopithecus afarensis* is different from the body structure suggested for *Homo habilis*.

(2)

- walks less upright
- Longer arms
- Smaller skull

ResultsPlus
Examiner Comments

Unless otherwise stated it was assumed that statements refer to Lucy based on the question. The language used in this response is comparative and it gained full marks for less upright, longer arms and smaller skull all being acceptable answers.

Question 5(a)iv

This question discriminated across the ability range of candidates sitting the paper. Marks were awarded for a selection pressure, change in the environment or named selection pressures linked to the idea the *Australopithecus afarensis* did not have advantageous adaptations or could not adapt which led to them being outcompeted. Responses that described the process of evolution were not credited as this does not explain extinction. Candidates must ensure that they answer the question which has been asked and not what they are expecting based on previous question papers.

(iv) Explain what could have caused the extinction of *Australopithecus afarensis*.

(3)

as new species of hominins evolved they out competed Australopithecus Afarensis ✓ as they had were more adapted to the environment so outcompeted for food and water and other resources and they couldn't survive the selection pressure

ResultsPlus
Examiner Comments

This gained one mark for outcompeted, a second mark for the idea that the new species was more adapted and the third mark for the link to food or a selection pressures. The response refers to selection pressures, adaptations and competition which are all key scientific terms.

(iv) Explain what could have caused the extinction of *Australopithecus afarensis*.

(3)

- Starvation

- wasn't able to adapt to changing environments, so couldn't survive.

ResultsPlus
Examiner Comments

Starvation implies a lack of food so gained the first marking point. Not able to adapt was credited from the additional guidance for the second mark. Changing environments would also have gained the first mark.

(iv) Explain what could have caused the extinction of *Australopithecus afarensis*.

(3)

- They could have faced a selection pressure like change in climate or competition.
- The better ~~ones~~ adapted ones would have survived and passed on their adaptations to offspring
- This would have happened over many generations until they evolved into a different species

ResultsPlus
Examiner Comments

This gained a mark for selection pressure/change in climate. They also gained the mark for competition. The better adapted ones survived does not explain extinction unless it refers to another species. The evolution of a new species does not answer the question but this type

of answer was common in the responses

Question 5(b)

Most candidates gained one mark on this question for the idea that prokaryotes have no nucleus or the reverse argument. More detailed responses did go on to state that eukaryotes have membrane bound organelles or mitochondria. Alternatively good responses included the idea that genetics was involved in the proposal of the three-domain classification system. Very few candidates linked all of these ideas together to gain full marks.

(b) Figure 6 shows how the three-domain classification system was developed.

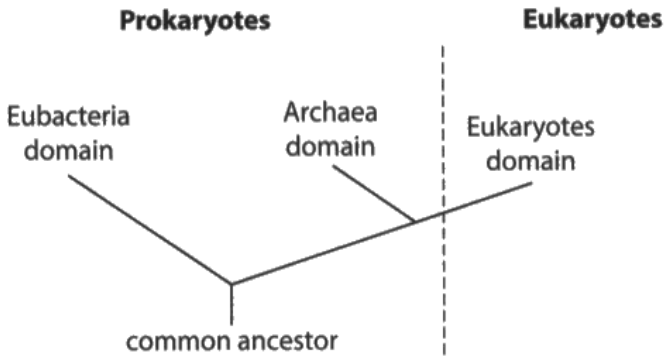


Figure 6

Describe the differences between prokaryotes and eukaryotes and why the three domain classification system was introduced.

(3)

prokaryotes have no nucleus, while eukaryotes have nucleus. prokaryotes are unicellular while eukaryotes are multicellular. prokaryotes are smaller in size any number than eukaryotes. ✱ The domain classification system was introduced because of genetic analysis and DNA/RNA

ResultsPlus
Examiner Comments

Ideas related to cell size, unicellular or multicellular do not describe the differences between prokaryotes and eukaryotes so were not credited. This gained one mark for prokaryotes having no nucleus and one mark for genetic analysis or the reference to DNA/RNA being the basis for the three-domain classification system.

(b) Figure 6 shows how the three-domain classification system was developed.

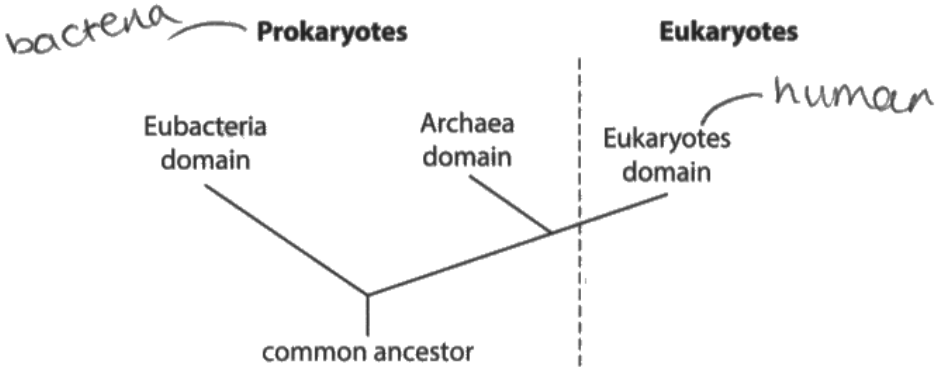


Figure 6

Describe the differences between prokaryotes and eukaryotes and why the three domain classification system was introduced.

(3)

The three domain system was introduced due to advancements in technology that allowed us to research more into the prokaryota category. Eukaryotes contain a nucleus, ~~[illegible]~~ and mitochondria. whereas the prokaryotes contain a cell wall, but no nucleus or mitochondria.

ResultsPlus
Examiner Comments

Advances in technology was too vague for the mark which needed to link to DNA/RNA or genetics. This gained a mark for the reverse argument of eukaryotes having a nucleus and that they had mitochondria. The cell wall and other cellular structure such as ribosomes or vacuoles were ignored as they do not answer the question.

(b) Figure 6 shows how the three-domain classification system was developed.

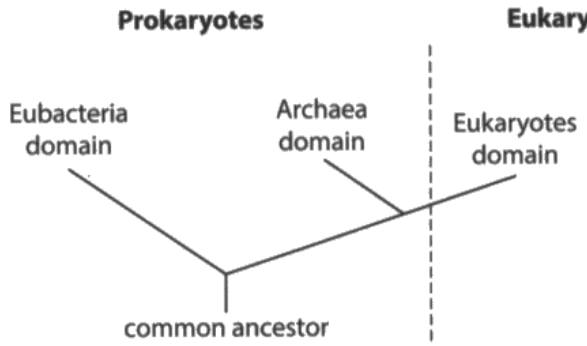


Figure 6

Describe the differences between prokaryotes and eukaryotes and why the three domain classification system was introduced.

(3)

Prokaryotes don't have a nucleus or mitochondria. They also don't have unused sections of DNA. Due to developments in genetic research, it was found that archea, who were thought to be ~~sister~~ to prokaryotes, had unused sections of DNA. This led to a need to differentiate between Eucaryotes, prokaryotes and Archea. That is because Archea and Eucaryotes have unused sections of DNA so have a common ancestor

ResultsPlus
Examiner Comments

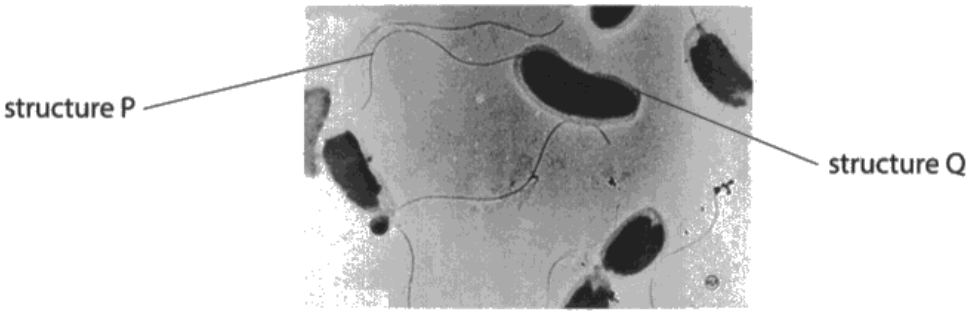
This high level answer gained two marks in the first sentence for no nucleus or mitochondria. They also gain the mark for the basis of the three-domain classification system for the idea of unused sections of DNA or the development of genetics.

Question 6(a)i

This question asked candidates to give the function of two structures identifiable from the diagram. Candidates lost marks when they gave the names of the structures and not functions. For structure Q the function of the cell wall capsule or cell membrane were accepted. The most common responses were that P was for movement and Q was for protection or maintaining structure.

6 (a) The pathogen *Vibrio cholerae* causes the disease cholera.

Figure 7 shows *Vibrio cholerae* bacteria.



(Source: Corbis)

Figure 7

(i) Complete the table to show the function of structure P and structure Q.

(2)

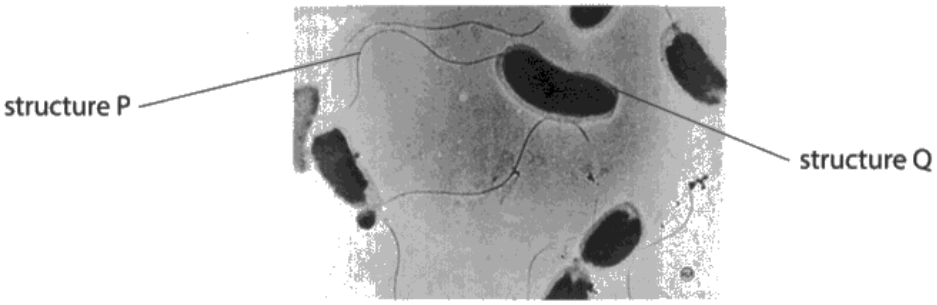
structure	function
P	flagella - to move/swim
Q	cell membrane - to control what substances move in and out of the bacteria

ResultsPlus
Examiner Comments

Movement or swim was acceptable for P and controlling what moves in or out of the cell was acceptable for Q from the additional guidance on the mark scheme.

6 (a) The pathogen *Vibrio cholerae* causes the disease cholera.

Figure 7 shows *Vibrio cholerae* bacteria.



(Source: Corbis)

Figure 7

(i) Complete the table to show the function of structure P and structure Q.

(2)

structure	function
P	flagella
Q	slimey outside layer

ResultsPlus
Examiner Comments

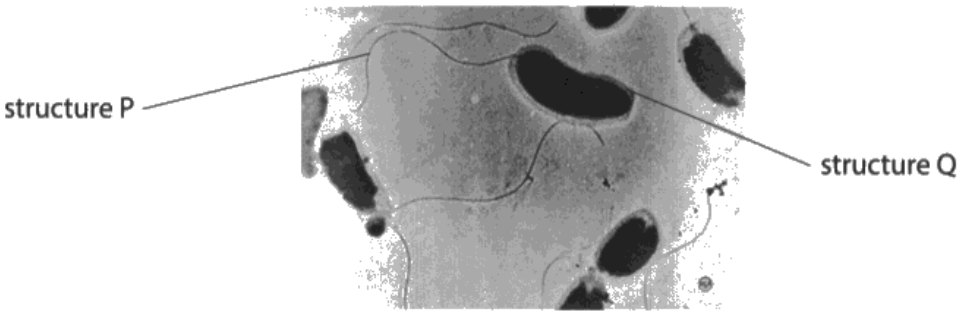
This scored zero as it identified structures but did not give the functions.

ResultsPlus
Examiner Tip

Always read the question carefully.

6 (a) The pathogen *Vibrio cholerae* causes the disease cholera.

Figure 7 shows *Vibrio cholerae* bacteria.



(Source: Corbis)

Figure 7

(i) Complete the table to show the function of structure P and structure Q.

(2)

structure	function
P	Movement
Q	Protecting cell helping the cell keep its structure

ResultsPlus
Examiner Comments

Movement gained the mark for P and protecting the cell or structure of the cell gained the mark for Q.

Question 6(a)ii

(ii) On the original image, the length of one bacterial cell is 12 mm.

The actual length of this bacterial cell is 2.0 µm.

Calculate the magnification.

(2)

image / actual

2 → 0.000002 µm

0.000002 / 12 × 100 =

actual / image

12 / 0.000002 × 100 = 600000000

magnification = × 600000000

ResultsPlus
Examiner Comments

This gained one mark. An answer of 6 to any error on the power of ten gained one mark. They have incorrectly converted units.

ResultsPlus
Examiner Tip

Know how to convert measurements between nanometres, micrometres and millimetres.

(ii) On the original image, the length of one bacterial cell is 12 mm.

The actual length of this bacterial cell is 2.0 µm.

Calculate the magnification.

(2)

Magnification = Image size / Actual size

Magnification = 12 mm / 2 µm = 0.12 mm / 2 µm = 0.06

magnification = 0.06

ResultsPlus
Examiner Comments

The only error in this calculation is the unit conversion and it gained one mark. The answer converts mm into m.

ResultsPlus
Examiner Tip

Magnification increases the size. Check your answers—logically magnification should be a number bigger than 1. Light microscopes typically magnify between x40 and x1000 with electron microscopes having even greater magnifications.

(ii) On the original image, the length of one bacterial cell is 12 mm.

The actual length of this bacterial cell is 2.0 µm.

Calculate the magnification.

Actual image / image size

(2)

12 / 0.002 = 6000

0.002 / 12 =

magnification = 6000

ResultsPlus Examiner Comments

This candidate has done a division both ways by the look of the workings but has the right answer on the answer line, gaining two marks.

Question 6(a)iii

The symptoms for cholera that were accepted included diarrhoea, nausea, vomiting, dehydration or stomach pain. Tolerance was applied to spellings, particularly for the word diarrhoea. General symptoms of infection such as fever or headache were ignored.

Question 6(a)iv

Most candidates gained the mark for recognising that *Vibrio cholera* is transmitted through water. Body fluids or contact were not credited.

(iv) State how the disease caused by *Vibrio cholerae* is transmitted.

(1)

by ingesting infected water - cholera is a waterborne disease

ResultsPlus
Examiner Comments

The link to water was sufficient for the mark on this question, it did not need to state infected or contaminated water. Water-borne would also have been credited.

Question 6(b)

Many candidates gain full marks on this question for lymphocytes produce antibodies against the pathogen's antigens. Fewer responses than previously seen confused antigens and antibodies. The idea that antibodies kill pathogens was not credited. High level responses went on to give the idea that pathogens clumped together by the antibodies were destroyed by phagocytes or during phagocytosis.

(b) Describe the specific immune response when a pathogen infects the body. (3)

The primary immune response begins as a lymphocyte that has complementary antibodies to that of the pathogen's antigens (is located). Once located, the lymphocyte divides rapidly by mitosis to produce many ~~lymph~~ lymphocytes (that are genetically identical) with lots of antibodies. These antibodies bind to the antigens ~~of the~~ on the pathogen causing the pathogen to die. The ~~b~~body will the create memory lymphocyte incase the pathogen comes again

(Total for Question 6 = 9 marks)

ResultsPlus
Examiner Comments

This gains all thee marks for lymphocyte, complementary antibodies and pathogen's antigen. They could not gain the additional marking point as they have antibodies causing the pathogen to die. This idea required phagocytes or phagocytosis.

(b) Describe the specific immune response when a pathogen infects the body.

(3)

pathogens have antigens on which alert our immune system and B lymphocytes produce antibodies to ~~attatch~~ attach to the antigens and the pathogens get clumped together, then a phagocyte engulfs the pathogens and kills them. Memory lymphocytes remember the antigen on the pathogen so if there is a future infection, antibodies will be made quicker.

ResultsPlus
Examiner Comments

This response has marks for pathogen's antigens, lymphocytes and producing antibodies in the first sentence. They also have the additional mark point for phagocytes engulf the pathogens.

(b) Describe the specific immune response when a pathogen infects the body.

(3)

- White blood cells attack pathogens
- antibodies attack antogens
- Body attempts to expell infection
  e.g. vommiting/dinorrea

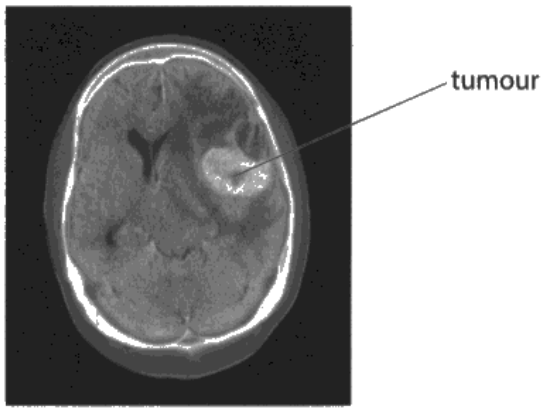
ResultsPlus
Examiner Comments

White blood cells attacking pathogens was not sufficient for the additional marking point. They have the idea that antibodies are produced so gained one mark. There is no indication of where the antigens are as it does not link to the pathogen so this mark was not awarded.

Question 7(a)i

The details of CT scans had not previously been assessed in this way and a range of marks were awarded for this question. Good answers included the idea that X-rays are absorbed by tumours with some linking this to the idea that tumours are more dense or that they are a mass of cells. Radiation was not credited for X-rays. Some misconceptions seen included that the X-rays were reflected by the tumours, or that some sort of tracer is involved. Some responses indicated that tumours had different densities but did not indicate that they were more dense.

7 (a) Figure 8 shows a CT scan image of a person with a brain tumour.



(Source: © DUCANE MEDICAL IMAGING LTD/SCIENCE PHOTO LIBRARY)

Figure 8

(i) Explain why tumours can be detected using CT scans.

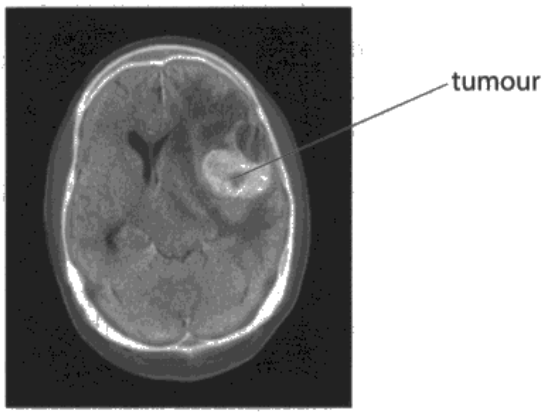
(2)

They are a large clump of cells. They are dense.

ResultsPlus
Examiner Comments

A clump of cells was credited as equivalent to a mass of cells. That tumours were dense was also acceptable.

7 (a) Figure 8 shows a CT scan image of a person with a brain tumour.



(Source: © DUCANE MEDICAL IMAGING LTD/SCIENCE PHOTO LIBRARY)

Figure 8

(i) Explain why tumours can be detected using CT scans.

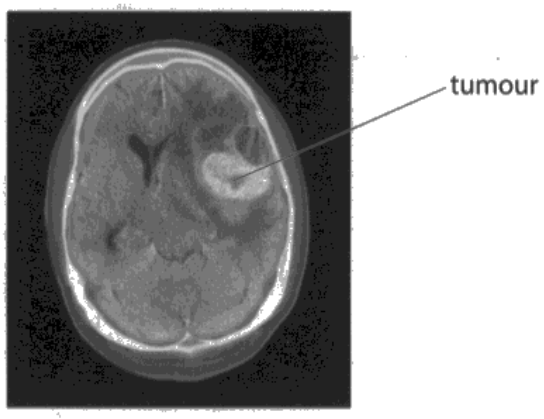
(2)

tumour cells are more dense than normal human cells. So, tumour cells absorb more X-rays hence detected using CT scan. As they are brighter

ResultsPlus
Examiner Comments

This explanation showed a good level of understanding and scored full marks for tumours being more dense and absorbing X-rays, illustrating all three possible marking points.

7 (a) Figure 8 shows a CT scan image of a person with a brain tumour.



(Source: © DUCANE MEDICAL IMAGING LTD/SCIENCE PHOTO LIBRARY)

Figure 8

(i) Explain why tumours can be detected using CT scans.

(2)

Because X-Rays are sent around the skull to give us an image and they show the growth of the tumor compared to the brain.

ResultsPlus
Examiner Comments

This has mp1 for X-rays. Just the idea of showing the tumour/the white area being the tumour or the tumour being highlighted was not sufficient as detecting tumours is given in the question.

ResultsPlus
Examiner Tip

Try to ensure you do not repeat the information in the question and that your answer includes more details.

Question 7(a)ii

Most candidates gained the mark for this question as tumours in the cerebrum or cerebellum would affect vision. The occipital lobe, hippocampus and frontal lobe were also accepted. The medulla oblongata was not credited.

Question 7(b)

Some responses to this question lack the detail required to obtain the marks. The first mark was for the idea of the glucose going to the tumour—just going to the brain was insufficient. The second mark was for the linked explanation aspect which included that the tumour cells are dividing, respiring or have a higher metabolic rate. The idea that they are more active was insufficient. Some candidates did gain a second mark for recognising that glucose is needed for respiration without gaining the first marking point.

(b) Tumours can also be detected by PET scanning.

Before a PET scan, a radioactive form of glucose is injected into the bloodstream of a person.

Explain why this glucose is injected before a PET scan.

(2)

- the tumor uses up more glucose for respiration
- it will release more radiation than the rest of the body

ResultsPlus
Examiner Comments

This gained a mark for the tumour uses glucose and the second mark was for respiration. The first marking point was awarded for the link between the glucose and the tumour and this could be obtained by different phrases including used by, entered, diffused into, bound to or found the tumour.

Question 7(c)

The level for this question was determined by the detail given for the production of monoclonal antibodies and their use in diagnosing blood clots. Most candidates were more confident describing the production rather than their use. Common errors seen included injecting the rodent with a pathogen, extracting antibodies not lymphocytes or that blood clots would be diagnosed with a test strip kit or using monoclonal antibodies with a coloured tag. Level 1 was awarded for limited knowledge on diagnosis or production. Level 2 was awarded for good knowledge of both aspects or detailed knowledge of one aspect. The top of the level was determined for using the key scientific ideas correctly. Level 3 required detailed knowledge on both the production of monoclonal antibodies and their use in diagnosis. Detailed knowledge for the production of mAb needed to include the role of an animal, the extraction of lymphocytes, and fusion to myeloma cells to create hybridomas. For the use of mAb, details needed to include the injection of the mAb into the patient and them binding to the blood clot which would allow the location to be determined. The top of the level was determined for using the key scientific ideas correctly.

*(c) Some monoclonal antibodies have been approved for use in the diagnosis of blood clots.

Explain how monoclonal antibodies are produced and how they can be used in the diagnosis of blood clots.– platelets

(6)

- inject specific antigen into a rodent (patient's platelets)
- rodent produces b-lymphocytes specific to antigen, producing ~~them~~ complementary antibodies ~~to kill pat~~
- ~~ext~~ isolate then extract the b-lymphocytes that produce complementary antibodies to specific antigen ~~and extr~~
- combine / fuse with a tumour cell forming a hybridoma cell
- this is because only b-lymphocyte can produce antibodies and only tumour cell can divide so now hybridoma can do both
- hybridoma can divide rapidly by mitosis forming lots of ~~mono~~ monoclonal antibodies ~~t~~ in a short time / fast

- inject monoclonal antibodies into patient attached to a radioactive isotope
- monoclonal antibodies will bind to patient's platelets and travel to site of blood clots
- PET scan shows location of radioactive isotope to diagnose if there are any blood clots in patient and if so their size and location dependant on volume of radioactive isotope detected in masses in the body.

(Total for Question 7 = 11 marks)

ResultsPlus
Examiner Comments

This response scored level 3, 6 marks. They have a detailed explanation of both mAb production and use in diagnosis with no errors or omissions in their explanation.

*(c) Some monoclonal antibodies have been approved for use in the diagnosis of blood clots.

Explain how monoclonal antibodies are produced and how they can be used in the diagnosis of blood clots.

(6)

- Inject a rat with the antigen present on the cells that form a blood clot.
- Remove the lymphocytes that are producing the antibodies from the rat and fuse it ~~with~~ with a tumour cell that would have been cultured in a lab.
- This form a hybridoma that is continuously dividing and producing antibodies.
- Remove the antibodies and incorporate them into a test strip by binding them to colour beads.
- Remove some of the human blood and place it on the test strip and see if it binds to the antibodies.

ResultsPlus
Examiner Comments

This is a level 2 response worth 4 marks. They have a detailed explanation of the production of monoclonal antibodies without errors and using scientific terms correctly. They cannot access level 3 as they do not have a detailed explanation of the use in the diagnosis of blood clots.

*(c) Some monoclonal antibodies have been approved for use in the diagnosis of blood clots.

Explain how monoclonal antibodies are produced and how they can be used in the diagnosis of blood clots.

(6)

To start, ~~an~~ antigen antigens are injected into a mouse or another animal as mice have immune systems that work similarly to ours. This triggers an immune response in the mouse who produces antibodies to kill the foreign antigen. These antibodies are usually found in the spleen of the mouse. The antibodies produced are then fused with myeloma cells which are cancerous white blood cells that can rapidly divide. This fusion creates hybridoma cells which rapidly reproduce to produce the antibodies that can be used to diagnose blood clots. When these monoclonal antibodies are injected into someone that has a blood clot, a lot of them will fuse to the antigens found on the surfaces of the cells during the blood clot. This means that a blood test can be taken from a person and a strip containing the monoclonal antibodies can be added. If there are a lot of antigens in the blood, that suggests a blood clot. These will bind to the monoclonal antibody creating a chemical change. The monoclonal antibodies can also be put into a patient that contain traces. These traces will pick up on the scanner indicating areas where a blood clot is present.

ResultsPlus
Examiner Comments

This scored level 3 and 5 marks. They have a detailed production of mAb and use in diagnosis. They are limited to 5 marks because they fused the antibody to the myeloma cell and there was no radiolabelling so there is some omissions and errors with their use of scientific terms.

*(c) Some monoclonal antibodies have been approved for use in the diagnosis of blood clots.

Explain how monoclonal antibodies are produced and how they can be used in the diagnosis of blood clots.

(6)

[illegible] Monoclonal antibodies can be produced by injecting ~~a mouse with b-lymphocytes~~. ~~with a [illegible] chosen~~ a mouse with a chosen disease / condition that you want to diagnose, in this case blood clots. The mouse will then produce b-lymphocytes which fight against blood clots. ~~[illegible]~~ these are then extracted from the mouse and reacted with a myeloma which is fast growing tumor cells to form a hybridoma. this creates ~~fast~~ cells that fight against blood clots and are fast growing, they're left to grow and replicate and can then be administered to patients with blood clots, helping them with its diagnosis.

ResultsPlus
Examiner Comments

This gains level 2 for a detailed explanation of the production of mAb. There was limited detail on diagnosis so level 3 is not awarded. They gained 3 marks as they injected a disease/condition into the mouse and not an antigen or blood clot related molecule so they lacked accuracy on their use of scientific terms.

Question 8(a)i

This question asked candidates how they would determine a median value.

- The mark was awarded for the idea that it was the middle value or that if all the values were put in order it would be the third one as five tests were completed.
- Just the idea that it was a third value was insufficient for the mark as the third test may not be the median value.
- Candidates who did not score on this question most likely stated how a mean would be calculated.

8 (a) Reaction time can be tested by dropping a ruler and measuring the distance it travels before it is caught.

Figure 9 shows how the test works.

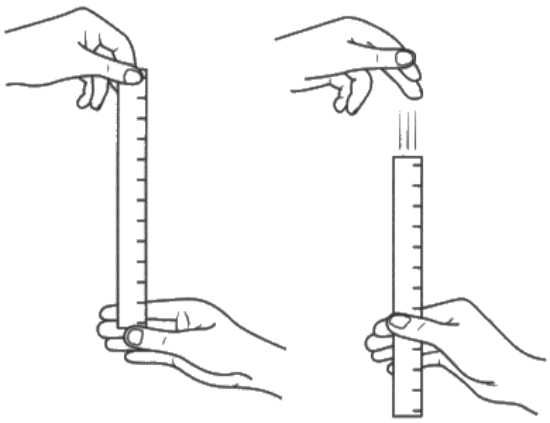


Figure 9

This method was used to test the reaction times of three students.

Each student completed the test five times and the distances were recorded.

(i) State how the median distance for each student could be determined from the results.

(1)

by using the result from the 3rd ~~test~~ test.

ResultsPlus
Examiner Comments

The third test is not necessarily the median value. If they had ordered the values and taken the 3rd value then this would have been acceptable for the mark.

8 (a) Reaction time can be tested by dropping a ruler and measuring the distance it travels before it is caught.

Figure 9 shows how the test works.

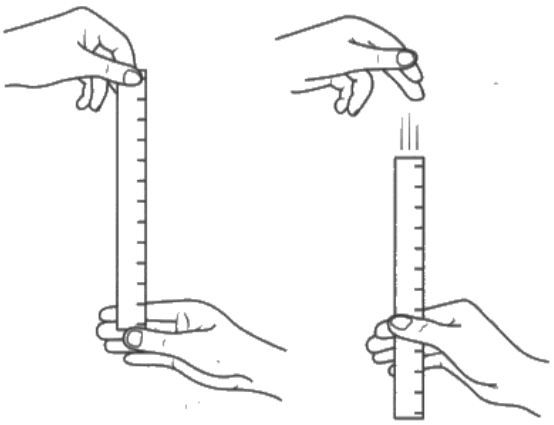


Figure 9

This method was used to test the reaction times of three students.

Each student completed the test five times and the distances were recorded.

(i) State how the median distance for each student could be determined from the results.

(1)

Order from shortest to longest distance and the middle is the median.

This explains how to determine a median value and was awarded the mark.

Question 8(a)ii

This question required candidates to identify one variable that would need to be controlled and to explain why this was necessary. Most candidates gave the idea of the starting point of the ruler or where the catching hand started. Few candidates made the link that variables are controlled to ensure validity or comparability of data. Controlling variables does not ensure reliability or accuracy. A common misconception was that the weight of the ruler or the length of the ruler would affect how far or how fast the ruler would drop.

(ii) State and explain **one** variable that needs to be controlled in this investigation.

(2)

The ruler needs to be dropped from the same height. This is so the students all have equal time to react to the ruler falling

ResultsPlus Examiner Comments

The ruler being dropped from the same height is a controlled variable but it only gains one mark as it is not linked to the explanation of being valid or comparable.

(ii) State and explain **one** variable that needs to be controlled in this investigation.

(2)

distance from hand and start of the ruler as if its dropped from higher up each time they'll have more time to react so results won't be comparable

ResultsPlus Examiner Comments

This illustrates a variable that can be controlled linked to the idea that if it was not controlled the results would not be comparable—for two marks.

Question 8(a)iii

Candidates who scored well on this question identified that student A had the fastest reaction time because they had the smallest mean distance or that the ruler fell the shortest distance. Many candidates identified that the distance the ruler fell decreased with repetition but they did not always explain why this occurred and only obtained one mark. Candidates should try to use data in a mathematical analysis when it is available in the question.

(iii) Figure 10 shows the results recorded for the three students.

student	distance in mm				
A	70	69	67	64	62
B	71	70	69	67	65
C	72	70	69	66	62

Figure 10

Explain **one** conclusion that can be made from the results in Figure 10.

(2)

Reaction time increased because the ruler was caught quicker.

ResultsPlus
Examiner Comments

This illustrates the misconception that reaction time increases if the ruler is caught quicker.

ResultsPlus
Examiner Tip

Reaction time is the time it takes to react-- an increased reaction speed leads to a decrease in reaction time.

(iii) Figure 10 shows the results recorded for the three students.

student	distance in mm				
A	70	69	67	64	62
B	71	70	69	67	65
C	72	70	69	66	62

Figure 10

Explain **one** conclusion that can be made from the results in Figure 10.

(2)

As each student had more attempts they had a better reaction with a shorter distance from the ruler.

ResultsPlus
Examiner Comments

This has a better reaction or shorter distance but does not explain the conclusion so only gained one mark.

(iii) Figure 10 shows the results recorded for the three students.

student	distance in mm				
A	70	69	67	64	62
B	71	70	69	67	65
C	72	70	69	66	62

Figure 10

Explain **one** conclusion that can be made from the results in Figure 10.

(2)

The Student A has the fastest reaction time as they have the lowest the mean score of distance the ruler travelled, therefore they were the quickest to react.

ResultsPlus
Examiner Comments

This gains full marks as they have a conclusion for student A and explained that it had the lowest mean distance which was sufficient.

ResultsPlus
Examiner Tip

If you have calculated a mean then include the value in your answer.

Question 8(a)iv

This question required the candidate to devise a plan and scored more highly than plan questions in previous series. Most candidates gained a mark for getting two students to each consume a different drink or for the same student consuming both drinks with a time interval in between. More detailed responses referred to the use of a control and that multiple students could be used or that mean could be calculated. When a variable was controlled the most common responses were the same volume of drink or the time in the interval between drinking and taking a test.

(iv) A student wanted to investigate the effect of two different drinks containing caffeine on reaction time using this method.

Devise a plan the student could use.

(3)

1. Have a student test their reaction time ~~with~~ with no caffeine in their system - test the same way as students A, B and C were tested.
2. Then get the student to drink the caffeinated drink, ~~energy drink~~ wait 10 minutes, then test their reaction time again
3. Repeat steps until no further change is shown.
4. Repeat ~~all~~ steps with the same student the next day with the other caffeinated drink

ResultsPlus
Examiner Comments

This scored full marks as they describe a control, have the same student drinking both drinks on different days and also give a controlled variable of waiting for 10 minutes.

(iv) A student wanted to investigate the effect of two different drinks containing caffeine on reaction time using this method.

Devise a plan the student could use.

(3)

Get a student to drink one of the drinks and do the ruler drop test 5 times then calculate the mean of their 5 scores. Then the next day give the same student the other drink so that ~~they don't~~ the caffeine from the drink the other day had worn off. Then ~~do the same as the other day and with~~ repeat the same steps for the next day and with both means calculated you can see the effect on the scores and compare

ResultsPlus
Examiner Comments

This gained one mark for calculating the mean values for one student's data and they describe the same student drinking each drink at different time points for the second mark.

Question 8(b)i

Candidates were asked to identify the labelled structure which is the cell body. The line is not pointing to the nucleus so this was not credited. Cytoplasm is not a structural feature of a cell.

Question 8(b)ii

Candidates were required to use figure 12 to comment on how the diameter of a neurone affects the speed of electrical impulses. Most candidates successfully identified that increasing the diameter increased the speed and many identified that the increase in speed was greater for myelinated neurones. Higher level responses successfully manipulated the data from the graph or indicated that the increase in speed for the myelinated neurones was linear.

(ii) Figure 12 shows how the diameter of neurones affects the speed of electrical impulses.

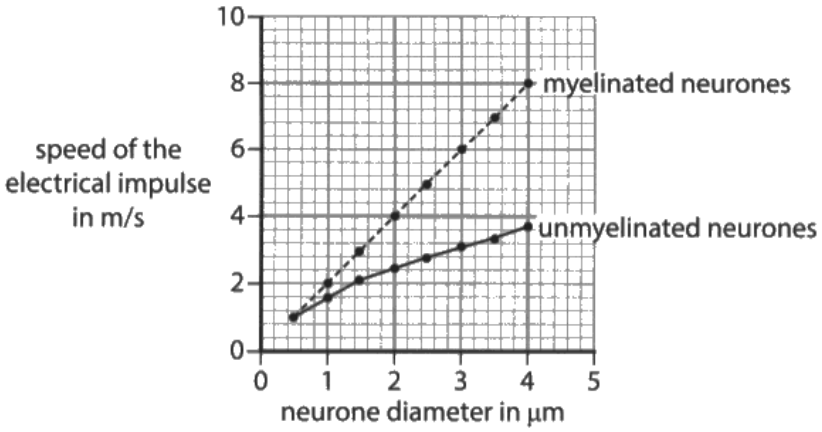


Figure 12

Comment on how the diameter of a neurone affects the speed of the electrical impulses.

(3)

As the diameter of the neurone increases, the speed of the electrical impulse increases and this is in a linear relationship for myelinated neurones, whereas unmyelinated neurones have a slightly more curved graph. ~~The myelinated~~

The myelinated neurones speed of electrical impulse increase at a faster rate than unmyelinated neurones due to having a myelin sheith, which helps to speed up the movement of the electrical impulses

(Total for Question 8 = 12 marks)

ResultsPlus
Examiner Comments

This gains full marks for giving the basic relationship between neurone diameter and speed of electrical impulse but clarifying that the relationship was linear for myelinated neurones. They also gained the third mark for the increase being greater for myelinated neurones.

Question 9(a)ii

Detailed responses to this question were limited. Many candidates only identified that the build-up of mucus would reduce the diameter of the airway or affect gas exchange. Higher level responses did refer to ciliated epithelial cells and how cilia would not be able to move the mucus which would trap pathogens or increase the chance of infection.

(ii) Cystic fibrosis causes the build-up of thick, sticky mucus.

Describe how the build-up of thick, sticky mucus affects the airways of a person.

(2)

Make their airways narrower causing weezing and chesty cough. also preventing cillia from being able to move the mucus.

ResultsPlus
Examiner Comments

This gained two marks for narrowing the airways or a cough and for preventing the cilia from moving the mucus.

(ii) Cystic fibrosis causes the build-up of thick, sticky mucus.

Describe how the build-up of thick, sticky mucus affects the airways of a person.

(2)

Airways get blocked by mucus ~~preventing~~ causing less air to enter and therefore less oxygen in blood.

ResultsPlus
Examiner Comments

This is an example of a common response gaining one mark. It does not give the key scientific details on the effect of the mucus on cilia or increased chance of infection.

Question 9(b)

The majority of candidates successfully completed the Punnett square for this question. Marks were not awarded if the letters used were not the same or if a sex-linked Punnett square was given. The explanation marks were awarded for identifying the 50% chance offspring being unaffected or affected. Higher level responses linked this to the correct science in terms of the alleles inherited. A minority of responses illustrated the misconception that there are carriers of dominant genetic diseases.

(b) Huntington's disease is a condition caused by a dominant allele.

Explain the phenotypes of the offspring of a genetic cross between a person who is heterozygous for the Huntington's allele and a person who is not affected.

Use the Punnett square as part of your answer.

(4)

heterozygous

unaffected	H	h
h	Hh	hh
h	Hh	hh

50% chance heterozygous ~~carrier~~
∴ phenotype ~~unaffected~~ ~~does not~~ has ~~have~~ disease
50% chance homozygous recessive
∴ phenotype does not have disease
~~100%~~ 50% offspring won't have disease as only one allele needed for trait to be expressed as condition is caused by dominant allele

ResultsPlus
Examiner Comments

This scored full marks. Two marks for the Punnett square, then two marks for the explanation that 50% are affected and 50% unaffected and those heterozygous have the disease and those homozygous recessive do not have the disease.

(b) Huntington's disease is a condition caused by a dominant allele.

what actually happens

Explain the phenotypes of the offspring of a genetic cross between a person who is heterozygous for the Huntington's allele and a person who is not affected.

Use the Punnett square as part of your answer.

(4)

	H	h
h	Hh	hh
h	Hh	hh

Affected | Unaffected

There is a 50% chance that their offspring will have Huntingtons disease as ~~the~~ 2 out of the 4 would inherit the dominant Huntingtons allele. ~~of the offspring~~ There* is also a 50% chance ~~of~~ of their offspring being unaffected as two of the four don't inherit the dominant Huntingtons allele and have a homozygous recessive genotype while the other offspring would have a heterozygous genotype. Therefore 2 out of 4 of their potential offspring will be affected by Huntingtons disease. This is due to the heterozygous parent being a carrier of the recessive gene, if they were homozygous dominant, their offspring would all have huntingtons disease.

ResultsPlus
Examiner Comments

This Punnett square gained two marks. The explanation refers to 50% affected and 50% unaffected linked to the affected person inheriting the dominant allele or for the unaffected not inheriting a dominant allele.

(b) Huntington's disease is a condition caused by a dominant allele.

Explain the phenotypes of the offspring of a genetic cross between a person who is heterozygous for the Huntington's allele and a person who is not affected.

Use the Punnett square as part of your answer.

(4)

	H	h
H	H H	H h
h	H h	h h

This has a 3:1 ratio of people who is affected. H would be the dominot allel. M- It would be a 75% chance of being affected and 25% not being affected.

ResultsPlus
Examiner Comments

This only gained one mark for completing a Punnett square from incorrect gametes. No further marks are awarded as there was no error carried forward as the candidate has demonstrated a lack of understanding of the genetic inheritance of the dominant disorder by giving the incorrect gametes initially.

Question 9(c)

This extended open response question was answered well by the majority of candidates. The detail given for the extraction of DNA from strawberries enabled most candidates to access at least level 2. Some candidates were then limited by a lack of information about the structure of DNA, possibly because they did not address this bullet point or that they just linked it to the idea that the structure of DNA is a double helix. High level responses were awarded full marks for sufficient detail on the reasons for the extraction stages and full details on the structure of DNA including hydrogen bonds between complementary base pairs. Candidates must ensure that they address all aspects of the question when answering extended open responses to allow them to access the higher levels.

*(c) Explain how DNA is extracted from strawberries.

Include in your answer:

- the reasons for each stage of the extraction process
- the structure of a DNA molecule.

(6)

Structure of DNA :- polymer made up of monomers called nucleotides, it is in a double helix shape -made up of a sugar, a phosphate + a base pair -base complimentary base pairs are held togeether by weak hydrogen bonds: A and T, C and G

Exctraction :- mush up the strawberries -add to salt - to help the DNA clump togeether + deergent to break down the membrane -filter mixture - to remove filtrate, ~~FLUID~~ -add mixture to ice cold ethanol - DNA is insoloble in it so it will form a precipitate.

ResultsPlus
Examiner Comments

This is a level 3 response worth 6 marks for detailed explanations of both the extraction of DNA linked to reasons for the extraction stages as well as the structure of DNA including the linking of complementary base pairs with hydrogen bonds.

*(c) Explain how DNA is extracted from strawberries.

Include in your answer:

- the reasons for each stage of the extraction process
- the structure of a DNA molecule.

(6)

- crush strawberries with resitel + water
  - so everything is cracked (DNA from inside)
- add to test tube with ethanol
  - subcellular structures become visible
- DNA is a double helix strand
  - bases on either end are complementary
- DNA taken out as it is now visible in nucleus
- nucleus cut with restriction enzyme
  - complementary sticky ends
- DNA taken out
- sealed with DNA ligase.

ResultsPlus
Examiner Comments

This response illustrates some misconceptions and lacks the detail required for above level 2. The response scores three marks for brief details on both the extraction and structure of DNA. They gain three marks as there is insufficient detail on the reasons for the extraction stages.

*(c) Explain how DNA is extracted from strawberries.

Include in your answer:

- the reasons for each stage of the extraction process
- the structure of a DNA molecule.

(6)

- crush the strawberry to increase the surface area and break down the cell wall
- add detergent + salt to the crushed strawberry that the DNA attatches to to make it visible
- filter the crushed strawberries, detergent and salt
- add cold ethanol to the crushed strawberry mixture as DNA is insoluble in ethanol
- a white stringy substance should form in the ethanol, this is the DNA
  ↳ double helix shape

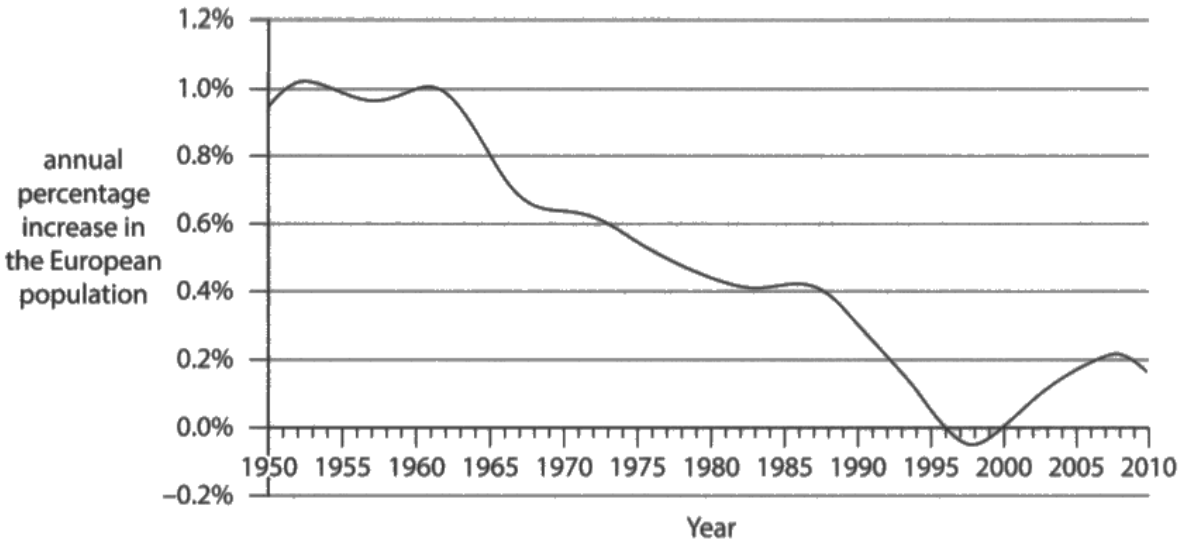
ResultsPlus
Examiner Comments

This illustrates the type of response seen where not all aspects of the question have been addressed. There is a detailed explanation of the extraction of DNA including the reasons for each stage but the only detail about the structure of DNA is the reference to a double helix. The response scored 4 marks.

Question 10(a)

The mark for this question was awarded for successfully identifying from the graph that there was no annual increase in the European population over a four year period between 1996 and 2000. The most common incorrect response was stating that this was for five years and candidates lost marks where they stated the range of years and not the number of years as required by the question.

10 (a) Figure 14 shows the annual percentage increase in the European population from 1950 to 2010.



(Source: *UN World Population Prospects: The 2012 revision*)

Figure 14

State the number of years when there was no annual increase in the European population.

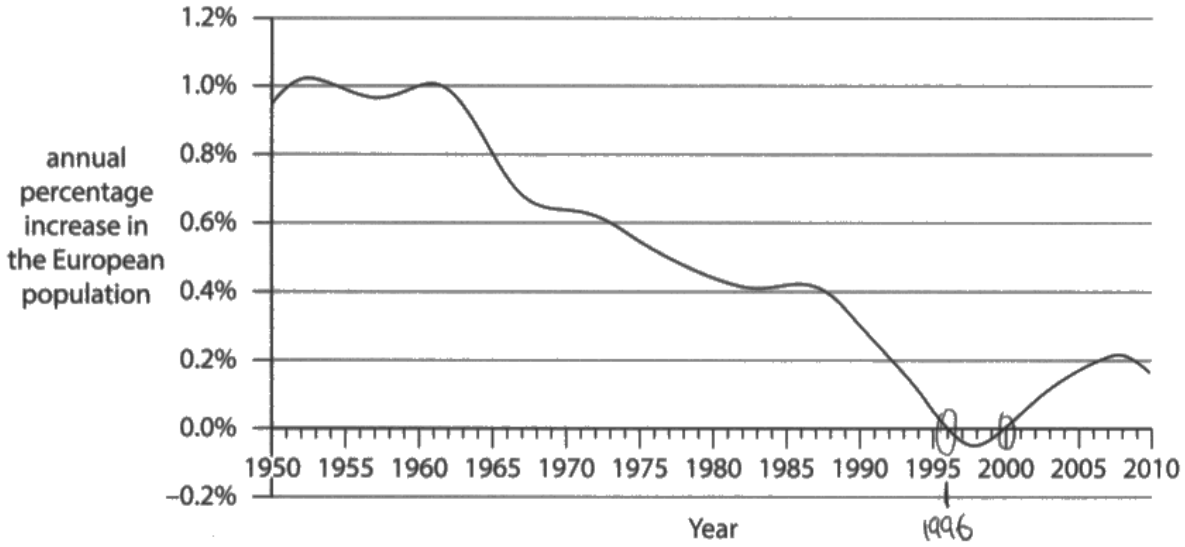
(1)

Four years.

ResultsPlus
Examiner Comments

The candidate has successfully calculated four years as the period of time where there is no increase in European population.

10 (a) Figure 14 shows the annual percentage increase in the European population from 1950 to 2010.



(Source: *UN World Population Prospects: The 2012 revision*)

Figure 14

State the number of years when there was no annual increase in the European population.

(1)

1996 and 2000

ResultsPlus
Examiner Comments

This is the years where the line crosses the x-axis but not the number of years as required by the question.

Question 10(b)i

This question was answered well by most candidates having included the idea that fertilisers increased crop yield for an advantage and the most common disadvantage seen was the idea that it runs off into water or causes eutrophication. Candidates must ensure that their answers include details as just that it damages the environment was insufficient for the mark.

(b) Fertilisers are used by farmers.

(i) Give **one** advantage and **one** disadvantage of using fertilisers.

(2)

advantage

Crops grow at a quicker rate

disadvantage

They can be expensive

ResultsPlus
Examiner Comments

Quicker growth rate is an advantage and expensive is a disadvantage so the response gains two marks.

(b) Fertilisers are used by farmers.

(i) Give **one** advantage and **one** disadvantage of using fertilisers.

(2)

advantage

increases crop yield

disadvantage

could leak into rivers / ponds causing eutrophication

ResultsPlus
Examiner Comments

This was the most common answer given with increased crop yield or growth for the advantage and leaking into rivers or eutrophication for the disadvantage.

(b) Fertilisers are used by farmers.

(i) Give **one** advantage and **one** disadvantage of using fertilisers.

(2)

advantage

Grows crops faster

disadvantage

Can be transferred to the environment, damaging it.

ResultsPlus
Examiner Comments

This response scored one mark. Faster growth was accepted for increased growth but damage to the environment too vague for a disadvantage—it needed a specific example.

ResultsPlus
Examiner Tip

Make sure to include specific examples in answers.

Question 10(b)iii

Not all candidates were able to successfully identify improvements that could be made to this investigation. The most frequent error was just to give the idea that more fertiliser concentrations should be used rather than focusing on the details of the investigation and identifying that these concentrations needed to be within the range already used. Good response is identified by the control field needed to be used for that variable to be controlled. Just the idea of repeating the investigation was insufficient for a mark on this question. The idea that different crops should be used is an alternative investigation and not an improvement to the current one and therefore was not credited.

(iii) The farmer concluded that the 5% solution of fertiliser was the best concentration to use.

State **two** improvements to this investigation that the farmer should make to confirm this conclusion.

(2)

1 Have a control with no fertiliser

2 Have a wider range of concentrations

ResultsPlus
Examiner Comments

This scored one mark for the idea of a control but a wider range of concentrations was not credited. It needed to be the idea of more concentrations within the range tested initially.

(iii) The farmer concluded that the 5% solution of fertiliser was the best concentration to use.

State **two** improvements to this investigation that the farmer should make to confirm this conclusion.

(2)

1 Add the fertiliser at smaller percentage intervals such as not every 2%

2 All grow the wheat in the same conditions such as temperature or soil PH.

ResultsPlus
Examiner Comments

This gained two marks, the first for the idea of using smaller increments and the second for controlling a variable for which soil pH was acceptable. The idea of using the same conditions was not credited and nor was temperature as this cannot be controlled in the field. The idea of field aspect was credited within the marking point for a controlled variable.

(iii) The farmer concluded that the 5% solution of fertiliser was the best concentration to use.

State **two** improvements to this investigation that the farmer should make to confirm this conclusion.

(2)

1 Repeat the test more times for each percentage concentration of fertiliser.

2 Repeat the test using other percentage concentrations of fertiliser, such as 2% and 7%.

ResultsPlus
Examiner Comments

This gained full marks. Just repeating the investigation was not sufficient: it needed to be clarified that this would be over a larger area or at each concentration of fertiliser as illustrated in this response.

Question 10(d)

Candidates demonstrated a good level of knowledge on the process of tissue culture to obtain genetically identical plants. Nearly all candidates gained two marks for taking a sample from the plant and placing it onto growth medium. Many candidates identified that hormones would be applied or that the plants would develop roots or shoots. Auxins were mentioned utilising knowledge from topic 6. High scoring responses also identified the need for aseptic techniques and these included sterilising the agar using an autoclave or disinfecting the sample obtained from the parent plant.

(d) Describe how tissue culture is used to produce genetically identical plants.

(4)

Take a cutting or sample of cells from a plant. Grow the plant in an nutrient agar growth medium containing growth hormones (Use sterile equipment and autoclave the agar growth medium) until the cells grow into a callus. Treat the callus with hormones to encourage cell differentiation so that roots develop. Plant the plantelet into soil and leave to grow.

ResultsPlus
Examiner Comments

Take a cutting is the first mark. Growing in agar is acceptable for a second mark, containing growth hormones is a third mark. Named hormones, eg auxins or rooting powder were accepted. Using sterile equipment or autoclaving the growth medium gives the final mark to obtain full marks for the question.

(d) Describe how tissue culture is used to produce genetically identical plants.

(4)

Extract cells from the meristematic region on the plants root and sheet tips. Place them onto agar jelly containing nutrients and auxins to promote the growth of the plants through Mitosis. After ~~some~~ a few weeks allow small plants to grow. finally, plant the new clones into soil.

ResultsPlus
Examiner Comments

Taking cells from a meristematic region is the first mark, agar jelly containing auxins is a further two marks.

(d) Describe how tissue culture is used to produce genetically identical plants.

(4)

~~A~~ Some cells are extracted from a plant and placed in a sterilised petri dish with agar in it. The cells are provided with all the nutrition they need and over time they grow into a ~~identical~~ clone of the original plant.

ResultsPlus
Examiner Comments

This response shows the common lower level of response seen with extracting cells from a plant and growing them on agar without any further detail on the tissue culture process.

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 and the quantity of additional information given should reflect the number of marks awarded for the question.
- When making comparisons ensure the language used is comparative with 'er' as a suffix to the words used in responses.
- 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 a specific format, such as number of significant figures. They should ensure they consistently apply rules for rounding up numerical answers.
- Ensure that when describing data from graphs and tables they identify the trends shown and use data in written responses and using mathematical analysis such as mean calculation is possible. A mathematical manipulation of the data is nearly always likely to be creditworthy. Candidates need to ensure readings from percentile charts are accurate.
- Make sure that key scientific terms from the specification are understood including diploid, prokaryotes, eukaryotes, allele and chromosome. When completing Punnett squares for inheritance, ensure that the same letter is used for the alleles.
- 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

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