

Examiners' Report
January 2012

GCE Biology 6BI02 01

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Introduction

This paper tested the knowledge and understanding of the two AS topics: 'The voice of the genome' and 'Biodiversity and natural resources'. The range of questions provided plenty of opportunity for candidates to demonstrate their grasp of these AS topics. On the whole, candidates coped extremely well with this paper, finding most of the questions straightforward to tackle; indeed there were very few examples of questions not being attempted at all.

There were some very good responses to questions that test recollection of factual information, such as cell ultrastructure and the process of mitosis, although many candidates fared less well when asked to apply their knowledge to unfamiliar situations. As always, there were questions in this paper which drew upon candidates' practical experience gained through carrying out the recommended core practicals, and it cannot be emphasised enough that the only way candidates can tackle these questions with confidence is by having actually done the practical work and investigations described in the specification. The questions testing understanding of the procedures involved in investigating the effects of nitrate concentration on plant growth, and of antimicrobial properties of garlic, were amongst those less well answered, highlighting a lack of appropriate practical experience. Those questions presenting information in tables or in graphs were generally interpreted well, although more care must be taken by some candidates when it comes to analysing this sort of data. Despite the many opportunities made available for candidates to demonstrate their knowledge and understanding in this paper, marks were frequently lost because questions had not been read carefully.

Question 1 (b)

This question was answered well by the vast majority of candidates, who appeared to have a sound grasp of the sequence of events during mitosis. As this was a QWC response - testing quality of written communication - some did lose marks as a consequence of spelling mistakes. It is advisable that emphasis be placed on correct spelling of technical words and phrases. The most common mistake was confusing centrioles with centromeres.

A good, clear answer scoring full marks.

*(b) Prophase is one of the stages of mitosis that could be seen using this process.

The two diagrams below show prophase in an animal cell.
Diagram 1 shows early prophase and diagram 2 shows late prophase.

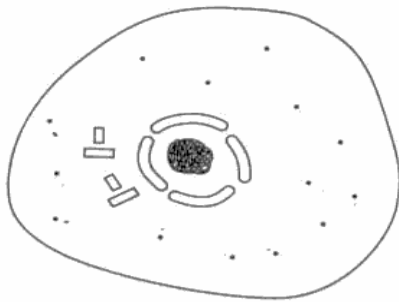


Diagram 1 (early prophase)

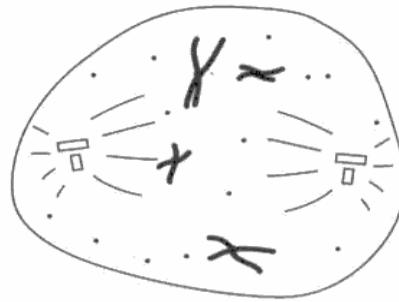


Diagram 2 (late prophase)

Using the two diagrams, describe the changes that occur from early prophase to late prophase.

(5)

In early prophase the nucleolus and the nuclear envelope are present. And the centrioles are towards the centre of the cell. Chromatin in the early prophase has not been used for the production of chromosomes. In the later stages of prophase the nucleolus disappears and the nuclear envelope breaks down. ~~The nucleolus has disappeared and nuclear envelope has broken down.~~ The chromosomes have condensed becoming short and visible. The spindle fibres have formed and the centrioles have moved to opposite poles of the cell.



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Examiner Comments

The first part of this response, describing early prophase, is unnecessary, but the second part lists the main features of late prophase in a logical sequence, with all technical words correctly spelled for the QWC component.



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Examiner Tip

Keeping to short statements instead of complicated sentences is a good approach.

• From early prophase to late prophase, the changes that occur are:

- Nuclear envelope breaks down.
- Nucleolus disappears
- Spindle forms
- Chromosomes have condensed, becoming visible
- Centrioles have moved to opposite poles of the cell.



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Examiner Comments

This example also scored full marks. The technical words were all correctly spelled and the sequence was more or less logical.



ResultsPlus
Examiner Tip

No mark would be awarded for 'spindle fibres' alone - it should state that they are being formed during late prophase.

However, this shows that the 'bullet point' approach can score highly and it can save precious time in exams!

Question 2 (a)

Most candidates were familiar with the concept of 'natural' selection. However, there were a surprising number who were under the impression that it can lead to extinction!

Although 'evolution' was the preferred answer for the second blank, reproduction was accepted as a logical inference and was a common answer provided.

2 Organisms are adapted to their environment which increases their chances of survival.

(a) Read through the following passage about adaptations to the environment. Write on the dotted lines the most appropriate word or words to complete the passage.

(3)

The process of *natural* selection can lead to adaptation, survival and *evolution*

There are three types of adaptations to the environment: physiological, anatomical and *behavioral*



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Examiner Comments

A straightforward example of a response that gained full marks.

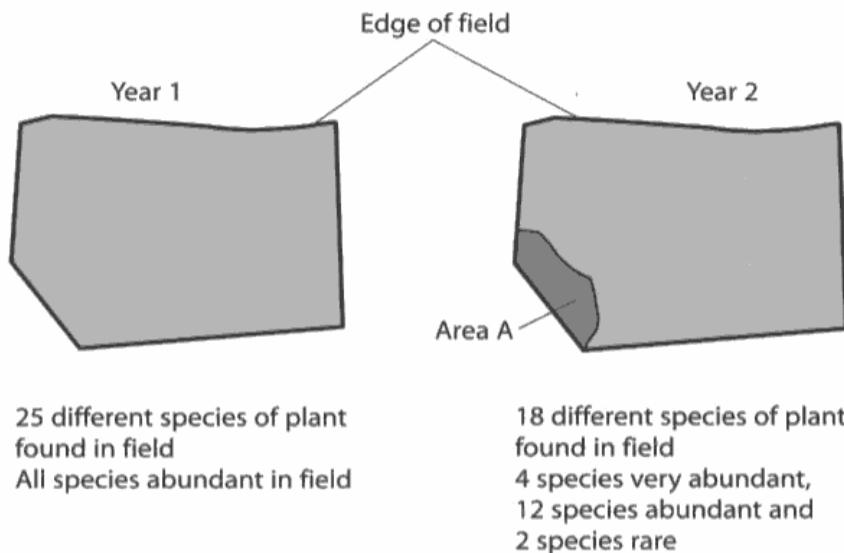
Question 2 (b)

This question was answered incorrectly by a significant proportion of candidates who had evidently failed to read the question. It clearly asked for responses to be chosen from the alternatives of 'physiological' or 'anatomical' adaptations, yet many used 'behavioural' for at least one of their responses. This highlights the necessity for careful reading of the instructions in a question in order to avoid throwing away marks carelessly.

Question 3 (a)

This should have been a very straightforward question, yet many candidates misinterpreted the data on the diagram. The diagram indicates that there were 25 species in Year 1, all of which were abundant, and that there were 18 species in Year 2, with details concerning the relative abundance of those species. Unfortunately, some added together all the figures for Year 2, coming up with a total of 36 species. It is essential that data is read carefully and that figures are related to the details provided.

- 3 A student studied one field in two different years.
She recorded some information, shown in the diagram below.



- (a) Using the information in the diagram, suggest in which year the species richness was greater. Give a reason for your answer.

(2)

- year 1 species richness was greater
- because the field had the most species ~~altogether~~ of plant



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Examiner Comments

By writing bullet points the candidate has ensured they have covered 2 points to gain 2 marks.

- (a) Using the information in the diagram, suggest in which year the species richness was greater. Give a reason for your answer.

(2)

Year 1, because species richness means where there is a larger variety of plants and year 1 had 25 different species.



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Examiner Comments

This response only gained one mark - stating that Year 1 had 25 species is not the same as stating that it had **more** species than Year 2.

Question 3 (b) (i)

It was pleasing to see that virtually all candidates recognised this to be mitosis and only a handful gave meiosis as their answer.

Question 3 (b) (ii)

This proved to be a challenging question. The ideal answer would have referred to asexual reproduction producing **genetically** identical offspring, which would result in a small gene pool for that population. Many candidates are still using the words 'genes' and 'alleles' interchangeably, which means they are not scoring any marks, despite having a reasonably good idea of the processes involved. It is the number of different alleles that brings about genetic diversity, and not the number of genes. Some good responses also included comparisons with sexual reproduction that generated genetic diversity through meiosis, and others also gained credit for noting that variation could develop as a consequence of mutation.

(ii) The genetic diversity of buttercup plants in the field is low.

Describe and explain why asexual reproduction results in low genetic diversity.

(2)

Genetic Diversity means the variety of different alleles in a gene pool of a species. If the genetic diversity is low, allele frequency in a gene pool is low. Less selective advantage. Less chances of survival and more chance of extinction. Asexual Reproduction produces cells that are genetically identical to each other and parents. No exchange of different alleles. Allele frequency stays same. Thus, diversity stays same is low. No new combination of alleles form.



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Examiner Comments

This example shows that the candidate clearly understands what is meant by the term 'genetic diversity' and can explain why asexual reproduction results in low genetic diversity.



ResultsPlus

Examiner Tip

Remember that asexual reproduction and mitosis produces 'genetically identical' cells - the word **genetically** is essential to get the mark.

(ii) The genetic diversity of buttercup plants in the field is low.

Describe and explain why asexual reproduction results in low genetic diversity.

(2)

The only source of genetic diversity is asexual reproduction is random mutations, these are so often corrected, or occur on spot. Whereas in sexual reproduction genetic diversity can come from a number of factors such as, independent assortment, chiasmata, or meiotic recombination, therefore it results in poor genetic diversity.



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Examiner Comments

This response focuses on the fact that only random mutations can bring about variation in organisms that reproduce asexually, and also describes how sexual reproduction can bring about variation. Although it does not state that asexual reproduction generates genetically identical organisms, this response still gained full marks.

Question 3 (c)

Questions that test the candidates knowledge of core practicals are not just asking for an account of an investigation that has been carried out by the candidate. There were a large number of responses that described investigations into the effect of nitrate deficiency or even totipotency of plant material, including reference to agar plates. It really is essential that candidates grasp the fact that they are being assessed on their ability to apply those skills and techniques learnt to problems that can be solved, using knowledge they should have learnt through carrying out the core practicals.

This question asked for a description of an investigation into the 'effect of varying nitrate ion concentration'. It also asked candidates to focus on how to produce 'reliable results'. In order to fulfil these criteria, a range of nitrate concentrations need to be suggested - and as there was no guidance regarding units, these were ignored on this occasion. A range has to be more than 'high, medium and low' for an AS Biology paper. We were looking for a minimum of 5 different concentrations.

Reliability is about producing results which can be repeated - not which are repeated. There is a subtle difference. Repeating the investigation at each concentration would improve the reliability of the data obtained. However, reliability is principally gained through controlling the variables in order that similar results could be obtained if the practical is repeated.

Many candidates dwelt on irrelevant details, such as making a hole in the foil covering the test tube and pushing the roots through the hole made. This wastes time and space and does not achieve marks.

An ideal response would start with the independent variable - the range of nitrate concentrations, mentioning a control with no nitrate to be used for comparison; then deal with the dependent variable, suggesting how it would be measured, perhaps with details about keeping the plant material as similar as possible to reduce variability in the data. Variables that should be controlled should then be described - environmental factors that could impact on the data being collected.

*(c) Another student noted that several species of plant did not grow as well in area A as they did in the rest of the field. He suggested this was due to a shortage of nitrate ions in the soil in this area.

The effect of varying nitrate ion concentration on the growth of one plant species can be investigated in a laboratory.

Describe how this investigation can be carried out to produce **reliable** results.

(5)

Plants from the same parents and which are at the same stage of development are obtained. Solutions containing various concentrations of nitrate ions and equal concentrations of all other ions and substances needed for growth ^{are} prepared. One solution containing no nitrate ions is used as a control. The initial length from shoot tip to root tip of each plant is recorded. Each one is placed in an equal volume of the solution. Variables such as light, temperature and length of the experiment are kept constant. After the set period of time, the length from the root tip to shoot tip of the plants is measured. The experiment is repeated several times at each concentration of nitrate ions. ~~with~~ The ^{initial} ~~first~~ measurement is subtracted from the final measurement of length. Mean is calculated at each concentration of nitrate ions. A graph of the results is plotted.



ResultsPlus Examiner Comments

This response gains a mark in the first sentence for stating that measures should be taken to ensure the plant material used is as similar as possible. Although there were not enough details about the range of nitrate ion concentrations to award a mark, credit is given for stating that all other ion concentrations would be kept 'equal' and that a solution with no nitrate would be used as a control. This answer also details how the growth will be measured, and states other variables that would need to be kept constant, such as light and temperature. A mark can also be given for stating that the experiment would be repeated 'several times at each concentration of nitrate ions'.



ResultsPlus Examiner Tip

This example shows how to fit an answer into the space available without using extra sheets! The secret is keeping to the essential facts and avoiding details that will not gain marks.

*(c) Another student noted that several species of plant did not grow as well in area A as they did in the rest of the field. He suggested this was due to a shortage of nitrate ions in the soil in this area.

The effect of varying nitrate ion concentration on the growth of one plant species can be investigated in a laboratory.

Describe how this investigation can be carried out to produce **reliable** results.

(5)

A suitable medium for growth of the plant such as nutrient soil is prepared with all the nutrients required except by manipulating the nitrate concentration of the soil used. A plant species is chosen and all the plants must have come from the same source and grown at the same conditions prior to the experiment. The initial weight and height of all the plants are measured. Soils of varying nitrate ions concentration of 0mol dm^{-3} , 2mol dm^{-3} , 5mol dm^{-3} , 10mol dm^{-3} and 15mol dm^{-3} are prepared with the rest of the nutrient concentration the same. The temperature, humidity and light intensity exposed to are all the same for all the plants. After a period of time the plants final weight and height are measured and compared to the initial readings. The experiment is repeated three times using the same conditions and the same plant species.



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Examiner Comments

This example describes an investigation in which the plants are grown in soil, which is perfectly acceptable, as there were no instructions that it should be carried out in culture solutions.

This response also gained full marks.

Question 4 (a)

(a) (i) It should have been very straightforward to plot a point on the graph, especially using the co-ordinates $x=10$, $y=700$, and then joining the points with straight lines. This is a basic mathematical skill and should not have caused a problem to any candidate, yet there were a significant number that failed to achieve more than 1 mark for this question. Others lost marks by drawing the error bars in the wrong place - this was a result of failing to read the scale on the y axis correctly.

(a) (ii) Many candidates misread the graph, failing to refer to the effect of sucrose concentration on pollen tube growth, instead inferring a time element to the x-axis and describing a change in length of the pollen tube with time. The pollen tubes themselves did not decrease in size at the higher concentrations of sucrose - however, their increase was not as much as it was at 10% sucrose concentration. At 20% there was still a greater increase in pollen tube length than at 5%, yet this was not acknowledged by many candidates. There were many simple, yet incorrect, references to pollen tube length increasing up to 10% sucrose concentration and then decreasing.

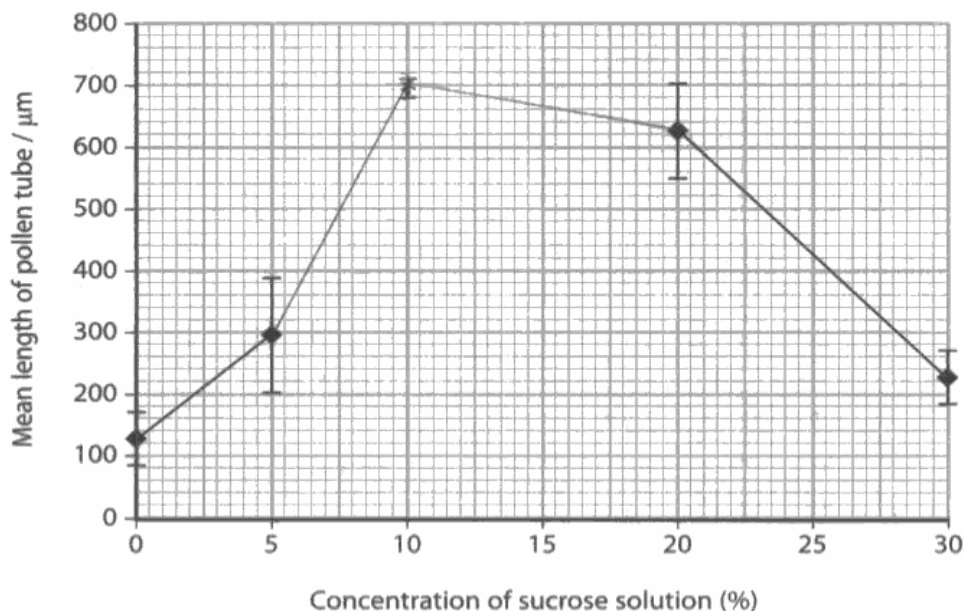
Many candidates also repeated data directly from the graph with no effort to manipulate the figures, which gains no marks. Even a basic subtraction of one figure from another to indicate that the pollen tube length was $580\mu\text{m}$ greater at 10% compared with 0% sucrose would have been creditworthy, yet was seldom seen.

- 4 A student investigated the effect of sucrose concentration on the growth of pollen tubes.

Four pollen grains were placed in a small dish containing water. The pollen grains were left for two hours and the lengths of the pollen tubes produced were measured. The mean length was then calculated.

This procedure was repeated using dishes containing sucrose solutions at concentrations of 5%, 10%, 20% and 30%.

The graph below shows the mean lengths of the pollen tubes from four of the five sets of results. Error bars showing the range are also shown.



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Examiner Comments

This candidate has correctly plotted the point on the graph and joined the points correctly. However, careless drawing of the top error bar has lost the third marking point.



ResultsPlus
Examiner Tip

Take care if asked to plot a point on a graph - follow all the instructions and double check the scale on each axis.

- (i) Using the information in the table, plot the mean length of pollen tubes and the error bar showing the range of data for the 10% sucrose solution and complete the graph.

(3)

- (ii) Using the completed graph, describe the effect of increasing sucrose concentration on the mean length of pollen tubes over the two-hour period.

(3)

From 0% to 10% a positive correlation is seen. As the ~~the~~ concentration of sucrose solution increases, ^{from 0% to 10%} the mean length of pollen tube increases. The greatest increase is from 5% to 10% ~~whereby~~ in which the increase was by ~~400µm~~ 400µm. From 10% to 30%, a negative correlation is seen. As the concentration of sucrose solution increases from 10% to 30%, the mean length of the pollen tube decreases. The greatest decrease is from 20% to 30% in which the decrease was by 400µm as well. The peak in mean length of the pollen tube is 700µm at 10% ~~sucrose~~ sucrose solution concentration.



ResultsPlus

Examiner Comments

This answer gains full marks. The candidate recognises that there is a positive correlation between pollen tube length and sucrose concentration up to 10% and then there is a negative correlation between 10 and 30%. Manipulation of the data has been carried out to describe the difference in growth between different sucrose concentrations - a calculated difference of 400µm for example - and not just a reference to the figures from the graph. A mark was also given for noting that the peak for growth was at 10% concentration.



ResultsPlus

Examiner Tip

Look out for the 'command' words in a question. Here it was 'describe'. No need for any explanation in the response, just a good description of what the data is showing.

Question 4 (b)

Although many candidates had a sound grasp of the sequence of events surrounding double fertilisation in flowering plants, there was a tendency to focus on this rather than the role of the pollen tube. Many candidates confused stigma with style, or even stamen, showing again the need for a clear understanding of biological vocabulary. There were also many references to the pollen tube nucleus producing enzymes, although AS Biology candidates should be aware that the nucleus is not the site for protein synthesis.

A good response would have started with the growth of the pollen tube through the style, using enzymes to digest the pathway to the ovary or ovule (not ovum). The role of the pollen tube in fertilisation is essentially for transporting the male gametes to the embryo sac, therefore references to the nuclei within the pollen tube, and the manner in which the generative nucleus divides to give rise to haploid nuclei, although correct, are not the details required for this particular question.

Candidates must be encouraged to read the questions critically, assessing which aspects of a topic are required, rather than rushing on to write down all the facts they recall concerning an area of biology they have studied.

(b) Explain the function of the pollen tube in fertilisation in flowering plants.

(3)

The pollen tube grows down the style and into the ovule.

The pollen tube transports the male gamete into the ovule.

This allows the male gamete and the female gamete to fuse and create a zygote.

The endosperm is also created.



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Examiner Comments

This response clearly gains 3 marks. One for 'pollen tube grows down the style', one for making it clear where it is heading - 'into the ovule' and the third for understanding that the pollen tube 'transports the male gamete'.



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Examiner Tip

Note how this candidate has separated their answer into short sentences? This is a useful technique when answering questions that have several marks to be gained.

(b) Explain the function of the pollen tube in fertilisation in flowering plants.

(3)

The pollen tube passes through the style of secreting enzymes to digest ~~at~~ the cells therefore it could penetrate through the style. It carries the generative ~~nucleus~~ which nucleus, which divides as the pollen tube passes in through the micropyle until it reaches ~~ovule~~ ^{the} ovary and then releases the male nucleus and the ~~a~~ second haploid nucleus (formed during the division of the generative nucleus) into the ovule.



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Examiner Comments

This type of response 'tells the story' - and therefore manages to get the sequence of events in the correct order.

Marks are given for having the pollen tube secrete enzymes (excellent phrasing!) to digest a pathway through the style. The candidate also describes the role of the pollen tube in carrying the generative nucleus, which divides to form the haploid gametes, to the ovule.



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Examiner Tip

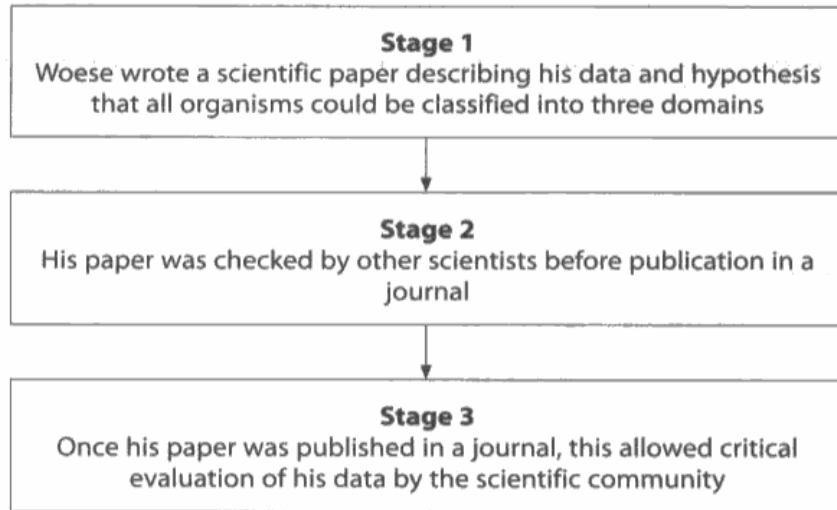
Many of the concepts covered in biology describe sequences of events - and recalling those events in a logical order will produce a good answer to an exam question, covering all the points.

Question 5 (a) (i)

The three domains were either known or not. It is necessary to be aware of the three domain system of classification. There were some interesting alternatives, including animals, fungi and prokaryotes, the latter being the most common incorrect response.

5 Woese, a scientist, collected data that allowed him to propose the hypothesis that all organisms could be classified into three domains.

(a) The diagram below shows some of the stages Woese used to publicise his new data and hypothesis.



(i) In stage 1, Woese suggested three domains, including the Bacteria and the Eukaryota (Eukarya). Name the third domain.

(1)

Archaea



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Examiner Comments

Although this example is spelled correctly, a variety of spellings were accepted, such as 'Archea' and 'Archeae'.

evaluation of his data by the scientific community

*Right letters I think
possibly not in the
Right order*

In stage 1, Woese suggested three domains, including the Bacteria and the Eukaryota (Eukarya). Name the third domain.

(1)

Almeaus



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Examiner Comments

A brave attempt here to throw random letters at the page in an effort to get some of them right!

However, there weren't quite enough correct ones, in the right places, to indicate that the candidate knew the answer.

Question 5 (a) (iii)

The emphasis here was on presenting data to the **scientific** community. This would not be achieved by television documentaries or by newspaper coverage. However, many candidates made creditworthy suggestions covering articles in scientific magazines to blogs on scientific websites.

(ii) In stage 2, Woese's paper was checked by scientists before publication.
Explain why his paper was checked by scientists at this stage.

(1)

In order to spot any mistakes before the paper was published.



ResultsPlus Examiner Comments

This is a typical example of a response that gained no marks. The concept of 'mistakes' is too vague - it could include typographical errors after all, which would not be checked for by other scientists.



ResultsPlus Examiner Tip

When it comes to evaluation of scientific data, there is rarely a situation where something is either right or wrong - it is all a matter of whether or not the data supports the conclusions being drawn from the data.

(ii) In stage 2, Woese's paper was checked by scientists before publication.
Explain why his paper was checked by scientists at this stage.

(1)

The other scientists checked if his data was valid and reliable. They made sure that the hypothesis he made is correct.



ResultsPlus Examiner Comments

This response gained a mark for referring to checking the data for reliability. The last sentence on its own would not have gained a mark - hypotheses are, by their very nature, neither correct nor incorrect.

(ii) In stage 2, Woese's paper was checked by scientists before publication.
Explain why his paper was checked by scientists at this stage.

(1)

To make sure he had not copied any g
~~his~~ their work or from elsewhere



ResultsPlus Examiner Comments

This example achieves the mark for stating, in simple terms, that the paper would be checked for plagiarism.



ResultsPlus Examiner Tip

If unsure of the specific terms to use, a clear description can often be creditworthy, especially for this type of question.

Question 5 (a) (ii)

The essence of this concerns peer-review, with reference to assessing the reliability of the data and the validity of the conclusion made.

Many responses quoted peer-review without really understanding what it involves.

(iii) Suggest **two** ways, other than publication in a journal, that scientists can use to present their data to the **scientific** community.

(2)

- 1 Through a scientific seminar or meeting
- 2 By publishing it on the internet in a scientific website



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Examiner Comments

This example clearly gains both marking points.



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Examiner Tip

Note that the use of the word 'scientific' has been used to describe both the type of meeting and the type of website. This makes it clear that the candidate has read the question and is being precise with their answer.

(iii) Suggest **two** ways, other than publication in a journal, that scientists can use to present their data to the **scientific** community.

(2)

- 1 scientific article
- 2 in scientific textbooks.



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Examiner Comments

This response only gains one mark. A scientific article, unqualified, is the same as 'a publication in a journal' and the question asked for suggestions other than that.



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Examiner Tip

Read all parts of the question - skipping details can cost vital marks.

Question 5 (a) (iv)

'Critical evaluation' of the data presented by a scientist would generally involve repetition of the methods involved in collecting that data so that other scientists in that field could ascertain its reliability. Otherwise there would be analysis of the data itself.

(iv) Explain what is meant by the phrase 'allowed critical evaluation of his data by the scientific community' in stage 3.

(2)

The scientific community can carry out new experiments/studies or repeat his experiments/studies, so to see if the same result can be obtained and see if his results are reliable.



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Examiner Comments

This example covers the repetition of experiments to see if the 'same results can be obtained' and also comments on checking the results for reliability, which implies checking the original data.

Two marks were given to this response.

(iv) Explain what is meant by the phrase 'allowed critical evaluation of his data by the scientific community' in stage 3.

(2)

His data will be evaluated by other scientist that will carry out the experiment to see if they can reproduce the result he has obtained. Other scientist will process the data and to see if his theory is acceptable or not.



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Examiner Comments

Note that no mark would have been given for merely stating 'his data will be evaluated by other scientists' as this basically repeats the stem of the question. However, marks were given for a description of repeating the experiment to see if the results can be reproduced, and then processing the data in the context of the original theory.

Question 5 (b)

Generally, this question was answered very well, with the vast majority having a clear grasp of the similarities and differences in cell structure between prokaryotes and eukaryotes. Surprisingly, it was the possession of a cell surface membrane by bacteria that was not always appreciated.

- (b) The table below compares some features of two domains.
Complete the table by placing a tick (✓) in the box, if the feature may be present in the domain or a cross (✗) if it is absent.

(4)

Feature	Domain	
	Bacteria	Eukaryota
Ribosomes	✓	✓
Smooth endoplasmic reticulum	✗	✓
Cell (surface) membrane	✓	✓
Slime capsule	✓	✗



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Examiner Comments

A clear example of a response that gains full marks.

- (b) The table below compares some features of two domains.
Complete the table by placing a tick (✓) in the box, if the feature may be present in the domain or a cross (✗) if it is absent.

(4)

Feature	Domain	
	Bacteria	Eukaryota
Ribosomes	✓	✓
Smooth endoplasmic reticulum	✗	✓
Cell (surface) membrane	✓	✗
Slime capsule	✓	✗



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Examiner Comments

This response was awarded 3 marks, as there was one mark available for each two correct boxes for this particular question. Incorrect responses for ribosomes and bacteria, and cell (surface) membrane for eukaryota.

The crossed out tick will always be marked as incorrect.



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Examiner Tip

Never, ever, put a line through a tick and expect it to be accepted as a cross - it will not be. If you put a tick first and then change your mind, cross it out several times and then put a clear, unambiguous, cross in the space available.

(b) The table below compares some features of two domains.
Complete the table by placing a tick (✓) in the box, if the feature may be present in the domain or a cross (✗) if it is absent.

(4)

Feature	Domain	
	Bacteria	Eukaryota
Ribosomes	✓	✓
Smooth endoplasmic reticulum	✗	✓
Cell (surface) membrane	✓	✓
Slime capsule	✓	



ResultsPlus
Examiner Comments

This response only gained two out of three marks. This is because the box for slime capsule and eukaryota has been left blank. A blank cannot be interpreted as a cross.



ResultsPlus
Examiner Tip

When asked to use ticks and crosses, remember to use both - don't leave blank spaces, it just looks as if you don't know the answer.

Question 6 (a)

It was apparent with this question that candidates appeared to think that putting 'oil is non-renewable, starch is renewable' would get them full marks. The most common incorrect answer referred to the structure of starch and how it made starch more suitable. Many also failed to identify the context correctly and therefore referred to fuels instead of packing materials, which consequently caused them to overlook the factor of biodegradability.

6 Plants produce a variety of material useful to humans, such as starch, cellulose and fibres.

(a) Starch can be used to form packaging.

Explain why it may be better to make packaging from starch rather than from oil-based products.

(2)

→ Starch is made from renewable resources while oil-based products are made from non-renewable resources
→ Starch is a biodegradable product while oil-based products are non-biodegradable, hence use of starch means - less pollution



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Examiner Comments

This is an excellent response, clearly comparing the two materials, and explaining the fact that the resources used to produce starch are renewable and those for oil based products are not. It also describes the relative biodegradability of the two materials.

6 Plants produce a variety of material useful to humans, such as starch, cellulose and fibres.

(a) Starch can be used to form packaging.

Explain why it may be better to make packaging from starch rather than from oil-based products.

(2)

• Made from plants, a renewable source rather than oil a non-renewable source
• Biodegradable therefore won't stay & build up in landfill



ResultsPlus
Examiner Comments

A clear response covering the two most common answers given.



ResultsPlus
Examiner Tip

Note the short sentences and bullet point approach - this produces clear answers.

6 Plants produce a variety of material useful to humans, such as starch, cellulose and fibres.

(a) Starch can be used to form packaging.

Explain why it may be better to make packaging from starch rather than from oil-based products.

(2)

Starch forms compact, globular ~~starch~~ structures making it easier to pack in a tighter space. Long chain hydrocarbons are difficult to pack in small spaces. Oil based products form byproducts like CO_2 which damages the atmosphere; starch does not.



ResultsPlus

Examiner Comments

This is an example of the type of response that discussed the structure of the starch molecule in terms of it packing into small spaces - rather than as a packaging material.



ResultsPlus

Examiner Tip

Check the context of the question and try to avoid making an answer you've learnt fit the question!

Question 6 (b)

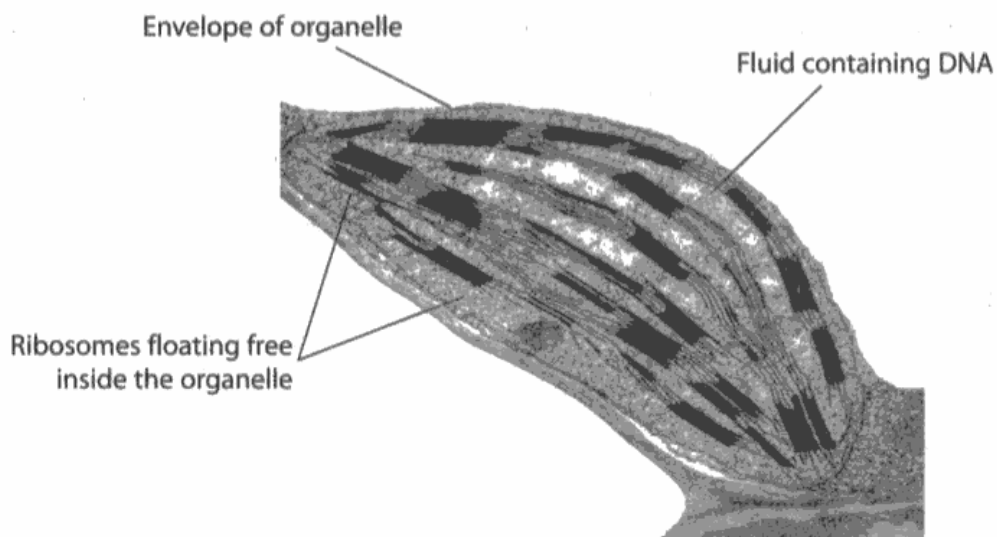
Most candidates recognised that amyloplasts contained starch and that cellulose is made of β -glucose monomers. However, the vast majority made the mistake of thinking that cellulose consists of microfibrils held together by hydrogen bonds, whereas it is the microfibrils that consist of cellulose molecules linked by hydrogen bonds. Candidates need to remember that cellulose itself is a polymer of β -glucose monomers joined by 1.4 glycosidic links and that it is unbranched.

Question 6 (c) (i)

Although most candidates did recognise this organelle as a chloroplast, there were many that confused it with a range of other organelles from nuclei (maybe due to the presence of DNA) to mitochondria, including the Golgi apparatus.

Candidates do need to be able to identify a range of cell organelles from both diagrams and electron micrographs.

(c) The organelle, shown in the electron microscope image below, contains the monomers of starch.



Magnification x10 000

Dr. Jeremy Burgess / Science Photo Library

A student incorrectly identified this organelle as rough endoplasmic reticulum because it had ribosomes inside it.

(i) Name this organelle.

(1)

Chloroplast α-glucose



ResultsPlus
Examiner Comments

A frustrating example of a candidate knowing the right answer and then having a crisis of confidence and changing it, in this case apparently referring to the phrase 'monomers of starch' mentioned in the introductory sentence and not the question which asked for the name of the organelle.



ResultsPlus
Examiner Tip

Always think twice before changing an answer - make sure every part of the question is double-checked first. Otherwise easy marks can be thrown away carelessly.

A student incorrectly identified this organelle as rough endoplasmic reticulum because it had ribosomes inside it.

(i) Name this organelle.

(1)

~~thylakoid~~ . chloroplast .



ResultsPlus Examiner Comments

Here is an example of an answer being changed sensibly!

Question 6 (c) (ii)

The vast majority of responses clearly described the differences in the structures of the two organelles. Only a few referred to differences in functions.

Most candidates seemed confident in their knowledge of cell ultrastructure.

(ii) Using the labels on the diagram and your own knowledge, give **two** reasons why it is **not** rough endoplasmic reticulum.

(2)

Reason 1 In rough endoplasmic reticulum, ribosomes are attached to the membrane of the organelle, not floating freely

Reason 2 There is no DNA inside the rough endoplasmic reticulum.



ResultsPlus Examiner Comments

Reason 1 clearly states that in rough endoplasmic reticulum the ribosomes are attached to the membranes and that it does not contain DNA.



ResultsPlus Examiner Tip

Remember that ribosomes are attached to the membrane of rER. Do not make vague statements about them being outside the membrane.

(ii) Using the labels on the diagram and your own knowledge, give **two** reasons why it is **not** rough endoplasmic reticulum.

Reason 1 Ribosomes are floating free inside the organelle. ⁽²⁾
~~and is not attached to the endoplasmic reticulum~~

Reason 2 Ribosomes not attached to endoplasmic reticulum.



ResultsPlus
Examiner Comments

Unfortunately this only gained one mark. The candidate has only described differences in distribution of ribosomes and has not mentioned any of the other features.



ResultsPlus
Examiner Tip

When asked for 2 examples, or 2 reasons, make sure they are sufficiently different and not just the same point phrased differently.

Question 6 (d)

There were many detailed descriptions provided of plant histology and the origin of the two tissues, neither of which was requested for this question. There were details provided for other plant tissues, which are not even on the specification. However, there were also a fair number of responses that described one or both tissues as possessing cytoplasm!

Many candidates appeared confused about the functions of these two tissues, many mistaking sclerenchyma for phloem. Those that did recall the functions of each tissue failed to score highly as they were not applying that knowledge to the question which asked for a comparison of the functions. It was necessary to state which functions xylem and sclerenchyma had in common and which ones they did not share to get full marks.

(d) The stem of a plant contains xylem vessels and sclerenchyma fibres.

Compare the functions of xylem vessels with the functions of sclerenchyma fibres.

(3)

Xylem vessels are not only used to support the plant as well as the sclerenchyma fibres but they are also used to transport water ~~and~~ minerals and ions up the stem of the plant to where it is needed using a diffusion gradient which the sclerenchyma fibres do not do.



ResultsPlus
Examiner Comments

This response gains full marks. It clearly states that both tissues are involved in support and then describes the functions of xylem in transporting water and mineral ions (even though listed separately as 'minerals and ions' in this example) whilst making it clear that sclerenchyma is not involved in transport.



ResultsPlus
Examiner Tip

Remember the command word 'compare' is asking for similarities **and** differences.

Question 7 (a)

Most candidates achieved the mark for correctly identifying the overall trend in the data, although some were misled by the arrangement of data in the table from highest concentration to lowest and stated that as 'concentration increased, the diameter decreased'. There were quite a few responses consisting of repetition of the data directly from the table, which scored no marks. Many candidates did work out that there was a difference from 100-60% and then from 60-20%, although few were able to express this clearly or to comment on 'direct proportionality above/below 60'. Some used the term 'proportional' incorrectly when describing positive correlation. Quite a few responses referred to the 'speed/rate of change', which is irrelevant when considering the effects of concentration over a set time period.

(a) Using the information in the table, describe the effect of the concentration of garlic extract on the mean diameter of the zone of inhibition.

(3)

As the concentration of extract increases the mean diameter of the zone of inhibition increases as well. The more the concentration of extract, the more ^{mean} diameter inhibition.
When 100% conc. → the mean diameter, 18 mm
" 20% " → " " 8 mm.



ResultsPlus

Examiner Comments

This candidate gets one mark only for describing the overall trend. Simply repeating data from the table, i.e. 18mm diameter at 100%, is not creditworthy.

If this candidate had worked out that the diameter of the zone of inhibition was 10mm larger at 100% than 20% concentration they would have scored 2/3 and not just 1/3.



ResultsPlus

Examiner Tip

Don't just copy figures from tables and graphs - do something with them.

(a) Using the information in the table, describe the effect of the concentration of garlic extract on the mean diameter of the zone of inhibition.

(3)

As the concentration of garlic extract decreases, the mean diameter of the zone of inhibition decreases. The decrease in the ~~the~~ mean diameter of the zone of inhibition when the concentration of garlic extract decreases from 60% to 20% is greater than that ~~in~~ when concentration of extract decreases from 100% to 60%.
From 100% to 60% of garlic extract, the decrease is only 1mm for ~~decrease by 40%~~ every 20%.
From 60% to 20% of garlic extract, the decrease is ~~3~~ 4mm for every 20% decrease, ~~greater increase by 4 times.~~
(b) Suggest which concentration of garlic extract has the strongest antimicrobial



ResultsPlus

Examiner Comments

A clear answer - this shows an appreciation of the main trend in the data and then the subtrends. This candidate has also identified the pattern in the data above and below 60% concentration and has expressed this correctly, referring to a decrease in diameter of '1mm for every 20% decrease' from 100 - 60%.

Question 7 (b)

This should have been a straightforward question, however it did generate a range of answers. Many achieved one mark for stating that the most effective concentration was 100% and another for linking it to the largest zone of inhibition. However, there were fewer who could then explain this in the context of more or most bacteria having been killed or inhibited from growing at this concentration. There were some instances where candidates apparently misunderstood the question and looked at the change in diameter and gave 40% or 60% as the best concentration, as after that the difference between successive concentrations was smaller.

(b) Suggest which concentration of garlic extract has the strongest antimicrobial properties. Give an explanation for your answer.

(3)

100% Garlic extract had the strongest antimicrobial properties. It had the greatest mean diameter of 18 mm, which meant it was able to kill the most bacteria amongst all concentrations.



ResultsPlus

Examiner Comments

A straightforward response, clearly identifying 100% as the most effective, linking that with the largest zone of inhibition and then realising that it killed most bacteria.

Full marks awarded here.



ResultsPlus

Examiner Tip

Remember - you don't always need to use up all the space available to achieve full marks.

(b) Suggest which concentration of garlic extract has the strongest antimicrobial properties. Give an explanation for your answer.

(3)

the 100% concentration of garlic extract has the strongest antimicrobial properties because it produces the largest ~~area~~ zone of inhibition - where bacteria are unable to grow or reproduce.



ResultsPlus
Examiner Comments

This response gets only 2 marks - one for identifying 100% as the most effective concentration, with reference to largest zone of inhibition. However, the candidate fails to explain their answer in terms of the most bacteria having been killed, or prevented from growing.

Question 7 (c)

There were those who grasped the difference between 'control' and 'controlled variable' and there were those who did not. The concept of using a control in order to assess what would have happened in the absence of the variable under investigation is not fully appreciated.

Incorrect responses included everything from temperature to 100% garlic.

(c) Suggest a suitable control for this investigation.

(1)

experiment repeated with 0% garlic extract.



ResultsPlus
Examiner Comments

Typical response that gained one mark.

(c) Suggest a suitable control for this investigation.

(1)

The temperature should be constant.



ResultsPlus
Examiner Comments

This was a common incorrect response, clearly confusing a 'control' with a controlled variable.

Question 7 (d)

It was evident that not all candidates had carried out this particular core practical as many did not grasp the fact that alcohol kills bacteria. Therefore, there were many confused answers concerning the alcohol interfering with the antimicrobial properties of the garlic.

There were few responses that scored full marks.

(d) The discs were sterilised by being placed in alcohol and then left to dry before being soaked in the extract.

Suggest why the discs should be sterilised before being soaked in the extract.

By sterilising the discs, this prevents the entry of any pathogens or harmful bacteria. Entrance of these harmful bacteria might interfere with the results and is also very harmful if it came in contact with the body. ^{and growth (2)}



ResultsPlus
Examiner Comments

This is an example of the type of response that referred to the prevention of growth of pathogenic bacteria as a result of contamination.

(d) The discs were sterilised by being placed in alcohol and then left to dry before being soaked in the extract.

Suggest why the discs should be sterilised before being soaked in the extract.

(2)

This is to ensure that no other microorganisms remain on the discs. These microorganisms could compete with the bacteria and prevent it from growing. This would hamper the experiment's reliability.



ResultsPlus
Examiner Comments

This is a good example of the type of response that shows an understanding of the idea that introducing other species of bacteria could result in competition, affecting the growth of the bacteria being studied.

Question 7 (e)

As there were two alternative correct responses to this question some candidates failed to commit to one in particular and therefore lost marks.

The question asked for a suggestion and an explanation, therefore it is important that candidates explain the suggestion they have proposed in order to gain full marks. For this question it would have been acceptable to suggest the zone of inhibition would have been larger due to the antimicrobial properties of the alcohol itself, or to suggest the zones would be smaller due to possible dilution of the garlic extract.

(e) Suggest how the results in the table might have been different if the discs had not been allowed to dry after being placed in alcohol. Explain your answer.

(2)

The inhibition zones would have been large because the alcohol would have killed some of the bacteria, making a bigger inhibition zone than just the extract alone.



ResultsPlus

Examiner Comments

A clear indication that the candidate recognised that the alcohol would also have killed the bacteria, resulting in larger zones of inhibition.

(e) Suggest how the results in the table might have been different if the discs had not been allowed to dry after being placed in alcohol. Explain your answer.

(2)

The mean diameter of zone of inhibition will be smaller as the garlic extract will be further diluted by the alcohol.



ResultsPlus

Examiner Comments

This shows a good example of the alternate answer that was accepted. Dilution of the garlic extract by the alcohol could possibly have resulted in smaller zones of inhibition.

Question 8 (b) (i)

The actual phenotype being investigated here is maze-brightness, the characteristic brought about by the interaction between genotype and environment. However, 'maze-bright' or 'maze-dull' were accepted, as was 'maze running ability'.

As this was an unusual example of phenotype, in contrast to a clear physical feature, many candidates failed to answer this correctly.

(i) State the phenotype of the rats being studied in this investigation.

(1)

maze-brightness



ResultsPlus
Examiner Comments

An ideal answer.



ResultsPlus
Examiner Tip

If there's only one line provided for the answer, it's a good indication that the examiners aren't looking for much more than a few words for a correct response.

(i) State the phenotype of the rats being studied in this investigation.

(1)

Their ability to run



ResultsPlus
Examiner Comments

Many candidates thought the phenotype under investigation was running ability or even intelligence, showing an incomplete grasp of the concept of phenotype.

Question 8 (b) (ii)

A wide range of answers were provided for this, although many mistakenly mentioned controlling the factors that were in fact under investigation - the actual cage conditions. Many sensible suggestions concerning the rats themselves - age, gender and breed, as well as the environment. Only one mark was available for an environmental factor as this was an investigation concerning mammals, and candidates should be aware of the wider range of variables to be considered.

(ii) Suggest **two** factors that need to be controlled in this investigation.

(2)

1 The nutrients given to the rats.

2 The age of rats.



ResultsPlus Examiner Comments

This response gains two marks - one for the nutrients given to the rats (hence diet) and one for the age of the rats.



ResultsPlus Examiner Tip

If asked for two factors, just give two. Bonus marks aren't given for coming up with a whole list of possible factors.

(ii) Suggest **two** factors that need to be controlled in this investigation.

(2)

1 The size and shape of the maze

2 The shape of the maze



ResultsPlus Examiner Comments

This response only gets one mark, as either size or shape of maze were too close to be separate marking points on the mark scheme. The mark was awarded for reference to keeping the maze the same.

Question 8 (b) (iii)

There were some excellent responses to this question, with many candidates doing an admirable job of interpreting the data correctly. There were only a few instances where maze-bright and maze-dull were interpreted as referring to the level of lighting in the maze itself - indicative of candidates who had not taken the time to read all of the information provided.

The question asked for a comparison to be made - this should include both similarities and differences.

(iii) Compare the mean error rate per rat for maze-bright rats and maze-dull rats in poor cage conditions and enriched cage conditions.

(3)

In the poor cage conditions the maze bright and dull mice ~~to~~ ^{have} more errors as they are not used to being tested with intelligence and have not played before whereas in enriched cage conditions both mice types are experienced with playing though maze bright mice show more signs of intelligence compared to maze dull mice.



ResultsPlus
Examiner Comments

This response only gets one mark for referring to more errors being made by the 'mice' kept in poor cage conditions, compared with enriched cage conditions.

This candidate has tried to explain the differences instead of comparing them.



ResultsPlus
Examiner Tip

When a question is about a particular species, in this case rats, make sure your answers refer to the same species.

(iii) Compare the mean error rate per rat for maze-bright rats and maze-dull rats in poor cage conditions and enriched cage conditions.

(3)

The mean error rate for maze-dull and maze-bright rats raised in poor cage conditions were identical as both had a mean error rate per rat of 50 ^{arbitrary units}. ~~both were significantly higher than the rats in enriched conditions.~~
The mean error rate for maze-dull rats raised in enriched cage conditions was higher by 2 arbitrary units than the maze-bright rats in enriched conditions. However the rats in enriched condition has significantly lower error rate, about 40 arbitrary units less, than the rats raised in poor conditions.



ResultsPlus Examiner Comments

This is a good example of the type of response that gained full marks. One mark is given for describing the error rate by both maze-bright and maze-dull rats as the same when raised in poor conditions. Two marks are available for stating that the maze-dull rats make 2 a.u. more errors than maze-bright rats when they are both raised in enriched conditions. The final sentence would also have been creditworthy if the candidate had not already achieved full marks.

Question 8 (b) (iv)

Many failed to note that this question only concerned the maze-dull rats, and therefore lost marks. Those that read the question carefully were able to score the first mark for describing the difference, although some just stated the figures without referring to fewer errors made by maze dull rats that grew up in enriched cage conditions, and therefore did not get the mark. However, it was more challenging to explain the differences, and fewer candidates correctly explained that the greater number of toys in the environment was necessary to affect the phenotype of those rats. Many achieved the second marking point by correctly suggesting that the environment that the rats were brought up in affected their phenotype.

(iv) Describe and explain the differences in the mean error rate per rat for maze-dull rats when they grew up in normal cage conditions and enriched cage conditions.

(2)

In normal conditions the difference between the 2 groups is the ~~got~~ greatest with maze-bright rats getting ~~the~~ an error rate of 10 per rat. this is ~~the~~ a rate 40 errors per rat lower than the maze dull rats who got 50 errors per ~~rat~~ rat



ResultsPlus

Examiners' Comments

This candidate has failed to read the question properly and described the differences between the two groups of rats both raised in normal cage conditions. As such, no marks can be awarded.



ResultsPlus

Examiner Tip

Read the question carefully and underline the key words - then refer to the relevant data only in either graphs or tables if required.

For this one the key words would have been 'maze-dull', 'normal' and 'enriched'.

(iv) Describe and explain the differences in the mean error rate per rat for maze-dull rats when they grew up in normal cage conditions and enriched cage conditions.

(2)

The maze dull rats that were raised in normal cage conditions had higher error rates than those in the enriched cage environment. This suggests that the phenotype for maze dull rats can be influenced by the environment they grow in.



ResultsPlus

Examiners' Comments

This is a good example, showing a clear grasp of the question. A description of the differences is provided followed by an adequate explanation for the observed difference.

Question 8 (b) (v)

This question referred only to the maze bright rats, specifically in normal and enriched cage conditions. The majority of candidates correctly noted that there was no difference in maze solving ability, however, very few attributed this to the rats having reached their genetic potential with just a few toys. There were also some suggestions that the rats learnt maze solving skills as a consequence of having to avoid the toys littering their cages, instead of actually playing with those toys - however, this did not affect the awarding of marks.

(v) Describe and explain the effect on the mean error rate per rat for maze-bright rats when they grew up in normal cage conditions and enriched cage conditions.

(2)

The mean error rate for maze-bright rats in normal cage conditions and enriched-cage conditions were equal. Even though there was a change in the environment, the rats may maze-bright rats may have reached their maximum genetic potential of being able to move around. That is why they made the the mean error rate did not change even as more toys were added.



ResultsPlus

Examiner Comments

A good response, stating that the error rate was equal for the rats brought up in the two different environments and going on to explain that the maze-bright rats had reached their 'genetic potential'.

Paper Summary

It is also essential that candidates do not try to force answers they have learnt into the questions set. Their focus should be in applying their knowledge and understanding of the questions to the best of their ability.

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