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Examiners' Report

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Introduction

Questions answered well included those on stem cells, cell specialisation, the structure of sperm cells, ultrastructure of cells apart from plasmodesmata, sustainable resources and the use of inorganic ions in plants. Those questions where the context was less familiar were more problematic. It is important that candidates learn how to apply their knowledge.

It appeared that quite a large proportion of candidates had learned answers from a previous mark scheme. Part of the answer was relevant and gained them some marks, however time may have been spent more effectively elsewhere on the paper.

Questions based on core practical work tend to differentiate between candidates who have not only had the opportunity to carry out these investigations, but have also been encouraged to write up these experiments using correct terminology and precise details, and candidates who have either not performed the practical work or not been asked to describe the method.

In questions that require a comparison to be made, it is essential to set out both sides of the comparison in order to gain credit. Many candidates made statements about only one side of a comparison and not the other.

The use of correct biological vocabulary is vital in this paper. However it was evident that terms such as genes and alleles or centriole and centromere were being confused. The correct spelling of biological terms is also important and this was assessed in question two. A significant number lost a mark because of incorrect spelling.

Question 1 (c)

The most common omissions on this question were candidates not referring to the cell wall or to the idea of linking cells.

Some candidates described the function of plasmodesmata rather than the structure.

(c) Some plant cells contain plasmodesmata.

Describe the structure of plasmodesmata.

(2)

Plasmodesmata is a channel open between the cell walls of adjacent cells, helps transfer nutrient and information between cells.



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Examiner Comments

This response gained 1 mark but did not make any reference to cytoplasm being in the channel to be able to be given a second mark.

(c) Some plant cells contain plasmodesmata.

Describe the structure of plasmodesmata.

(2)

They're cytoplasm-filled channels connecting cells. They don't have a primary nor secondary cell wall.



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Examiner Comments

This is a good example of what we were looking for and gained both marks. It has a comment about cytoplasm, the connection between cells and the lack of cell wall.

(c) Some plant cells contain plasmodesmata.

Describe the structure of plasmodesmata.

(2)

Areas where there is no cell wall and cytoplasm links two adjacent cells.



ResultsPlus

Examiner Comments

Both marking points were awarded as this is the exact phrase used in the mark scheme guidance.

(c) Some plant cells contain plasmodesmata.

Describe the structure of plasmodesmata.

(2)

cytoplasm filled channel join 2 adjacent cell together. do not have middle lamella and primary cell wall and secondary cell wall - endoplasmic reticulum could pass through it.

(Total for Question 1 = 6 marks)



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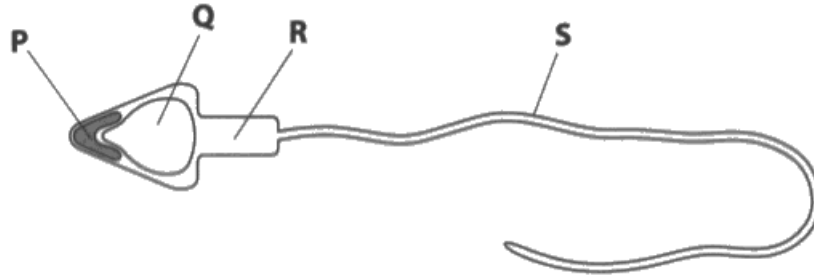
Examiner Comments

Although the answer is not particularly well expressed it still gained both marks. The reference to a cytoplasm filled channel gained the second marking point and the idea of no cell wall gained the first marking point. The whole answer is in the context of adjacent cells.

Question 2 (a)

Only the name acrosome was allowed. The vast majority of candidates named this correctly and gained the mark. A few candidates wrote acrosin but this is an enzyme found in the acrosome and is not the name of the structure itself.

2 The diagram below shows a sperm cell.



(a) Name the structure labelled P.

(1)

Acrosome



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Examiner Comments

This candidate like the vast majority of candidates wrote the correct answer and gained one mark.

Question 2 (d)

This was well answered with the majority of candidates gaining both marks. The most common reason for a loss of a mark was when candidates did not indicate the destination of the sperm.

Very few candidates referred to the transfer of DNA which would have gained credit.

(d) Describe the role of structure S.

(2)

It is a flagellum tail containing microtubules made of contractile tissue which produces whip-like movements to help the sperm move and propagate towards the ovum - its role is to help the sperm swim and move to the ovum.



ResultsPlus
Examiner Comments

A very clear answer that describes movement and also indicates the destination of the sperm as the ovum.
This gained 2/2

(d) Describe the role of structure S.

(2)

S is the flagellum, the tail of the sperm cell. It is long and thin and is powered by the mitochondria at R. It enables the cell to move/swim towards the ovaries.



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Examiner Comments

This gained one mark for stating it allowed the cell to move but did not get a second mark as the reference to ovaries is incorrect. We accepted egg cell and secondary oocytes as alternatives to ovum.



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Examiner Tip

Make sure you use the correct biological terminology particularly when there are words that have similar sounds but very different meanings such as ovum and ovary.

Question 2 (e)

This was a QWC question where we were looking for the correct spelling of biological terms. A significant number of candidates lost a mark because of incorrect spellings. Words penalised for incorrect spelling included allele, assortment, chromosome, homologous and most frequently, independent.

Other errors included using the word gene instead of allele. A large number of candidates described in depth the process of spermatogenesis and this often resulted in the gain of one mark only for including a statement about haploid gametes being produced. Others gave a detailed account of the stages of meiosis without linking their answer to variation.

*(e) Explain the role of meiosis in the production of genetically variable sperm cells.

(5)

Meiosis produces genetic variation by either crossing over which is the swapping over of chromatids or independent ~~to~~ assortment to produce new combination of alleles. Meiosis produces haploid gametes with half the number of ~~the~~ chromosomes of a body cell, so when the gametes fertilise, they produce a diploid zygote.



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Examiner Comments

This response scored two out of five marks. Marks were only given for the reference to crossing over and for production of haploid gametes. The incorrect spelling of assortment prevented marking point 6 being given because of QWC. The phrase "new combination of alleles" has to be in a clear context of chromatids or gametes.

*(e) Explain the role of meiosis in the production of genetically variable sperm cells.

(5)

Meiosis is the type of cell division that gives us four genetically different, haploid daughter cells. Sperm cells are haploid, which means they only have half the ~~new~~ number of chromosomes, each from each homologous pair. This means that when a sperm cell fertilizes an egg cell, which is also haploid, a diploid zygote is formed from both cells. This combines characteristics of both which increases the genetic diversity. ~~From~~ Meiosis makes these 4 cells genetically variable by the random assortment of the chromosomes, which are distributed to each daughter cell, and the crossing over during the first division. Crossing over occurs when homologous pairs of chromosomes exchange genes at a point known as chiasmata, which increases the combinations of different characteristics as well as the genetic diversity.



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Examiner Comments

This candidate gained four of the available five marks. These were for stating that haploid cells will be produced, for correctly naming the processes of crossing over and independent assortment and near the end of the answer, the candidate refers to chiasmata in the context of crossing over.

* (e) Explain the role of meiosis in the production of genetically variable sperm cells.

(5)

Meiosis increases the number of genetically different cells through asexual reproduction. It involves independent assortment and cross over. Independent assortment gives rise to genetically different chromosomes and cross over involves swapping alleles on chromatids to increase genetic diversity.



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Examiner Comments

Only one mark was given which was for the description of swapping alleles on chromatids. The spelling of independent is incorrect so a mark was lost because of QWC. We expected the specific term crossing over to be used rather than cross over.

Question 3 (a)

This question was well answered with many correct references to sustainability and to the fact that plant based plastics are biodegradable.

Candidates should indicate that the plant based plastics are made from renewable resources, rather than stating that the plastics themselves are renewable.

3 Plant-based plastics are being developed to replace oil-based plastics.

Sugar and corn crop plants have been used to make some of these plant-based plastics.

(a) Give **two** advantages of using plant-based plastics compared with oil-based plastics.

(2)

1. plant-based plastics are sustainable and can be re grown.
2. whereas oil-based plastics are finite resource and unsustainable.



ResultsPlus Examiner Comments

One mark was awarded for knowing the plant based plastics are a sustainable source.
A second mark would have been awarded if the answer stated that the plants rather than plastics can be grown.

3 Plant-based plastics are being developed to replace oil-based plastics.

Sugar and corn crop plants have been used to make some of these plant-based plastics.

(a) Give **two** advantages of using plant-based plastics compared with oil-based plastics.

(2)

1 They are biodegradable

2 They are a renewable source that can be grown again.



ResultsPlus

Examiner Comments

Only one mark was awarded.

This was for the reference to the plastics being biodegradable.

However, a second mark could not be given as the plastic itself is not renewable.

It needs to be clear that it is the plants that the plastics were made from that are renewable.

Question 3 (b)

Candidates would have benefitted from being more careful when summarising the data. The question required a comparison of plant based plastics and oil based plastics. However a significant number compared oil based plastic A to oil based plastic B or compared sugar based plastics to corn based plastics. Candidates also needed to make sure that they referred to both plant based plastics when making a comment about the ozone layer.

It is important for candidates to understand that they need to manipulate data rather than extract values from the graph.

Using the information in the graphs and your own knowledge, discuss whether the production of plant-based plastics is less environmentally friendly than the production of oil-based plastics.

(4)

plant based plastics are show to have a greater effect at damaging the ozone and causing eutrophication sugar based plastics (1.0) and corn based plastic on effect on ozone (0.88) and on eutrophication (0.12) the effect of oil based plastic A is more than corn based plastic₁ and oil based plastic B on eutrophication the effect of oil based plastic A is more than oil based plastic B on the effect on ozone layer.



ResultsPlus Examiner Comments

This gained two of the four marks. The opening statement refers to both sugar and corn so gains a mark for the comment about the ozone layer but not for the reference to eutrophication as we expected a statement in the context of sugar based plastics only. A second mark was awarded for comparing oil based plastic A to corn based plastic but the end of the answer is not relevant as it compares A to B. Copying data from the graph is not sufficient to gain a mark, we expect the data to be manipulated.



ResultsPlus Examiner Tip

Marks for describing data in a graph will only be awarded if the data has been manipulated. Merely copying data from the graph will not gain credit.

↳ Using the information in the graphs and your own knowledge, discuss whether the production of plant-based plastics is less environmentally friendly than the production of oil-based plastics.

(4)

In both cases (eutrophication and effect on ozone layer) sugar-based plastics had the greatest effect, whilst corn-based plastic effected the ozone more than ~~either~~ eutrophication. Both graphs show that the products with the ~~most~~ ^{greatest} effects are plant-based plastics and this is because a lot of fertilisers are used to be able to make them which causes harm to the ozone layer and contributes to eutrophication greatly (if sugar-based plastic) and so compared to oil-based plastics they are less environmentally friendly.



ResultsPlus
Examiner Comments

Only one mark was awarded.

The opening statement about the ozone layer was not given a mark because the context needed to be about both plant-based plastics. References to fertilisers are not given credit because it is in the stem of the question.

Question 3 (c)

This proved to be a straightforward question for the majority of candidates, although a small number referred to nitrogen ions rather than to nitrate ions.

The functions of nitrate and magnesium ions were usually correctly stated, while the role of calcium ions caused some confusion.

- (c) Fertilisers are spread on the land to supply plants with the inorganic ions that they require for growth.

Explain how plants use named inorganic ions.

(3)

Plants use inorganic ions such as:

- Nitrates - which are ~~essential~~ ^{needed} in forming DNA and amino acids, which are essential for

growth.

- Magnesium ions - to form chlorophyll and increase photosynthesis rates for a greater yield.

- Calcium ions - needed for the formation of middle lamella and calcium pectate.

- Phosphate ions - needed for the production of nucleotides and ATP.



ResultsPlus
Examiner Comments

This gained all three marks as it had four correct statements.

- (c) Fertilisers are spread on the land to supply plants with the inorganic ions that they require for growth.

Explain how plants use named inorganic ions.

(3)

plants need to grow for that they need various mineral ions eg nitrate to produce for the production of DNA and amino acids. calcium which not only helps to absorb ions but strengthens the structure of the plant magnesium is need to form chlorophyll (a green pigment that absorbs sunlight for photosynthesis) a lack of magnesium will cause discolouring of the plant.



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Examiner Comments

Two marks were awarded for correct statements about nitrate and magnesium ions.

Question 3 (d)

Candidates often referred to ultraviolet light but did not make it clear that this was an environmental factor. There were some strong answers referring to oncogenes and tumour suppressor genes.

Some answers seemed to focus on skin pigmentation and did not really answer the question set.

(d) Ultraviolet light has been shown to increase the risk of skin cancer.

Suggest how skin cancer is the result of an interaction between genotype and the environment.

(3)

Due to ultraviolet radiation (which is the environmental factor) there are mutations caused in the genes which result in skin cancer occurring. Phenotype is the interaction between environment and the genotype.



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Examiner Comments

This was awarded two marks as the candidate clearly states ultraviolet light is an environmental factor and they have the idea of uv light causing mutations.

(d) Ultraviolet light has been shown to increase the risk of skin cancer.

Suggest how skin cancer is the result of an interaction between genotype and the environment.

(3)

cancer can be passed on genetically so is affected by genotype. But environmental factors such as too much sun exposure also affect the phenotype. The sun can ultraviolet light from the sun can cause mutations hence making oncogenes and deactivating the tumor-suppressing genes. This can cause uncontrolled cell division and no check of the cells produced hence showing that skin cancer is affected by genotype and environment.



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Examiner Comments

This gained the full three marks available. The candidate correctly refers to oncogenes and has the idea that control of the cell cycle is lost.

Question 4 (a)

The majority of candidates clearly understood the meaning of totipotent cells. Sometimes a mark was lost for stating that totipotent cells can differentiate into most or many cell types, rather than all cell types.

(a) The morula consists of totipotent stem cells.

Explain the meaning of the term **totipotent stem cells**.

(2)

This are the cells that can develop any cells of a tissue except the embryonic tissue cells.



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Examiner Comments

No marks were awarded. Without the final five words a mark would have been given for the idea of any cell type.

(a) The morula consists of totipotent stem cells.

Explain the meaning of the term **totipotent stem cells**.

(2)

undifferentiated (unspecialised)
stem cells that can give
rise to all types of
cells



ResultsPlus
Examiner Comments

Two marks were awarded for this clear statement.

Question 4 (b)

It was expected of candidates that they would indicate that the cells produced will be genetically identical (rather than just identical). It was quite common for answers to be given two marks for descriptions indicating that mitosis increases the cell number and produces genetically identical cells. However many candidates omitted details of the cell cycle in their response, so did not include statements about organelle production or DNA replication in interphase.

(b) Explain the role of mitosis and the cell cycle in the formation of the morula from the zygote.

(3)

By mitosis, the cell divides into many cells that are genetically identical to one another. As cell cycle continues, these cells increase in number to form a ball of 8 stage cells called morula. New cell organelles formed by cell cycle.



ResultsPlus Examiner Comments

Two marks were given. There are clear statements about an increase in cell number and the fact that the cells will be genetically identical. However, a third mark was not given as the comment about organelle formation is not in the context of interphase.

(b) Explain the role of mitosis and the cell cycle in the formation of the morula from the zygote.

(3)

In Interphase: duplication of organelles, DNA replication & cytoplasm enlargement. Mitosis produces 2 daughter genetically identical & this is important for growth to increase number of cells. Asexual reproduction to reproduce genetically identical cells organisms.



ResultsPlus Examiner Comments

This is a good answer that gained the full three marks and is an example of all four marking points.

Question 4 (c)

A lot of candidates gained full marks on this question, demonstrating that this was a topic that was well understood. A small number, however, confused transcription and translation.

- (c) The blastocyst consists of two types of cell, trophoblast cells and the inner cell mass.

Cells in the inner cell mass are pluripotent.

Explain how the cells formed from the inner cell mass become specialised.

(3)

Inner cell mass receives certain electrical and chemical triggers switching some genes on. The switched on genes are transcribed into mRNA and the mRNA is translated into specific amino acid sequence forming protein. This protein determines the structure and function of the cell.



ResultsPlus Examiner Comments

Three marks were awarded as four correct statements are given including correct references to transcription, translation and the production of protein which determines the cell structure and function.

- (c) The blastocyst consists of two types of cell, trophoblast cells and the inner cell mass.

Cells in the inner cell mass are pluripotent.

Explain how the cells formed from the inner cell mass become specialised.

(3)

A chemical stimulus is provided e.g. a signal protein or some growth substance. Some genes are activated. Transcription of mRNA takes place at these active genes. The mRNA undergoes translation to produce proteins which determine the structure of the cell.



ResultsPlus Examiner Comments

Three marks were given for correct references to transcription, translation and the production of protein which determines the cell structure and function.

Question 5 (a)

Many candidates wrote answers to this question that were based on a previous mark scheme. They would have benefitted from reading the question more carefully and noting the difference in context. The stem of the question refers to endemic lemurs but very few candidates mentioned endemism in their answer.

(a) Explain how endemic lemurs evolved in Madagascar.

(3)

Endemic lemurs will have in Madagascar the appropriate food to eat and their perfect climate to survive, what will make them reproduce and maintain the species in that area. They will have evolved to different species of lemur when different genes were passed from one generation to the next. Different characteristics and advantageous genes that have been moved from one generation to another would have made the lemur evolve, because not every lemur will have survived and reproduced.



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Examiner Comments

No marks were given.

The answer does not quite describe the idea of different conditions on Madagascar. Also to gain a mark for the formation of new species, it was expected to be in the context of natural selection.

(a) Explain how endemic lemurs evolved in Madagascar.

lemurs are endemic to Madagascar which means that they (3) belong and are unique to Madagascar and aren't naturally found anywhere else in the world. Selection pressure like predation and diseases created struggle for survival. Mutations in the gene cause different alleles within the species. ~~Species without a~~ lemurs without advantageous alleles would struggle to survive and die, reducing competition. Lemurs with advantageous alleles would survive and get all resources and reproduce lots of offspring with the same advantageous alleles. Over time, this leads to evolution and only lemurs with advantageous alleles would exist.



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Examiner Comments

Only one mark was awarded for stating what endemic means.

The reference to selection pressure is not a comparative one (comparing Madagascar to mainland Africa). The answer needs to refer to different conditions or selection pressures.

(a) Explain how endemic lemurs evolved in Madagascar.

Endemic means these lemurs are found only in Madagascar. (3)

When the monkeys were carried across the sea from Africa to the Madagascar, their habitats changed.

There Due to different selection pressures applied on the monkeys, different monkey with the selective advantage to that pressure survived. The selective advantage is maybe due to variation among the monkey, due to mutations. The monkeys that are selected for survived and the rest did not. As when they interbreed the new alleles are passed onto their offspring and the allele frequency in future generations increases. This gives rise to a whole new species called lemurs that have adapted to the conditions in Madagascar.



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Examiner Comments

This was a relatively rare answer that gained three marks.

There is a statement to explain what endemic means followed by a description of different selection pressures on Madagascar. Near the end of the answer is a description of new species being formed which is in a suitable context.

Question 5 (b) (iii)

In questions such as these it is important for candidates to read the stem very carefully, as the important term here is 'change'. Candidates that mentioned only hunting as a factor did not gain a mark; there needs to be an indication of an increase in hunting.

(iii) Suggest **two** reasons for these changes.

(2)

1. loss of natural habitat

2. less food available and presence of diseases



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Examiner Comments

One mark was awarded for this answer.

Loss of habitat and decrease in food were alternatives for the same marking point in our mark scheme.

The comment about disease lacks the context of an increase.

(iii) Suggest **two** reasons for these changes.

(2)

1. Loss of habitat, due to deforestation.

2. Selection pressure such as predation.



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Examiner Comments

One mark was given for the idea of loss of habitat. However, a second mark was not given as there is no context of an increase in predation.

Question 5 (b) (i)-(ii)

Many candidates correctly completed the calculation in part (i), but very few gained all four marks in part (ii). This was often due to candidates not calculating the overall increased threat of extinction and therefore omitting statements such as 'there was an increase of 47' or that 'the threat had doubled'. Other errors in part (ii) included candidates misinterpreting the graph and thinking that the increased length of the bars in the graph indicated that there was a larger population of lemurs.

- (i) There were 103 known species of lemur in 2012.

Calculate the percentage of species of lemur that are included in these IUCN categories in 2012.

$$(23 + 49 + 20 + 2 = 94) \quad (3)$$
$$\frac{94}{103} \times 100 = 91.26\%$$

Answer 91.26 %

- (ii) Use the information in the graph to describe how the threat of extinction has changed from 2008 to 2012.

(4)

The threat of extinction from 2008 to 2012 has increased. The ^{number of} critically endangered species have increased by 17. The endangered species have had the greatest increase of 27 and the vulnerable species have increased by 11. Whereas the number of species which were threatened have decreased by 8.



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Examiner Comments

The calculation is correct so all three marks are given in part (i).

In part (ii) two marks out of four were given.

These were for stating that the general trend is that the threat of extinction has increased and for selecting a specific example of an increase such as the critically endangered category.

To gain a mark for manipulation of data we wanted the total increase in threat to be calculated rather than individual increases. The last line misses out the word 'near' so the statement is now about threatened species rather than near threatened species so it cannot be accepted as describing the only category that decreased.

- (i) There were 103 known species of lemur in 2012.

Calculate the percentage of species of lemur that are included in these IUCN categories in 2012.

$$\begin{aligned} \text{Percentage} &= \frac{\text{new quantity} - \text{original quantity}}{\text{original quantity}} \times 100 \quad (3) \\ &= \frac{94 - 47}{47} \times 100 \end{aligned}$$

Answer 100 %

(ii) Use the information in the graph to describe how the threat of extinction has changed from 2008 to 2012.

(4)

From 2008 to 2012 more species have become Critically endangered, endangered and vulnerable.

Near threatened rate is decreased from 10 in 2008 to 2 in 2012.

The highest increase is in the Endangered species from 17 in 2008 to 49 in 2012.

Vulnerable species had the least change, from 14 in 2008 to 20 in 2012.



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Examiner Comments

Part (i) The calculation was awarded two marks as the value 94 gained marks for correct working even though the final answer is incorrect.
In part (ii) two marks were awarded. The candidate has correctly given an example of a category in which there was an increased threat and a category in which there was a decrease in the number of species.

Question 6 (a) (i)

A number of candidates stated the garlic has no effect above 80%. However the graph shows all bacteria are killed.

- (i) Use the information in the graph to describe the effect that the concentration of garlic extract has on this species of bacteria.

(2)

First of all, small concentrations of garlic extract (0-20%) have no effect on bacteria, but from there, as the percentage of garlic extract concentration increases, more bacteria start dying. After 40% this happens at a constant rate of increase. At 80-100% of garlic extract concentration, all bacteria are killed.



ResultsPlus
Examiner Comments

Two marks were awarded as there were correct descriptions of the parts of the graph from 0-20% and from 80-100%.

- (i) Use the information in the graph to describe the effect that the concentration of garlic extract has on this species of bacteria.

As the concentration of garlic extract increases the percentage of bacteria killed also increases. ⁽²⁾ ~~As the~~ (positive correlation). For example at 40% concentration of garlic extract the percentage of bacteria killed was 20% but at ~~60%~~ 60% concentration of garlic extract the percentage of bacteria killed was 60%.



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Examiner Comments

No marks were given as the answer only quotes individual values from the graph rather than the idea of ranges of values.

Question 6 (a) (ii)

When describing practical work, candidates tended not to give details about the dependent variable. Candidates were expected to indicate what would be measured (eg the diameter of the clear zone) and not merely state that the clear zone would be measured.

Very few candidates described the need to use different types of bacteria at each concentration.

This was a QWC question in which clarity of expression is important. Some answers were clearly written, showing that the candidates had a good understanding of the practical work they had experienced. However in a few answers clarity was lacking and perhaps reflected that the candidates had not experienced writing up practical work.

*(ii) Describe an investigation to determine the effect of the concentration of garlic extract on other species of bacteria.

Prepare a sterile agar by ^{dissolving} using agar powder in a hot water. leave it to be warm then add a known volume of bacterial culture and stir for even distribution, then pour in a sterile (6) petrie dish

Crash the garlic extract in an alcohol to kill bacteria.

Then pipette different concentrations of garlic extract on sterile filter discs (10%, 20%, 30%, 40%, 50%).

Place the filter discs at equal distance from each other on the petrie dish ~~don't open it~~, then close it with a lid. After few hours observe the inhibition zone and measure the diameter to calculate area without opening the lid.

Repeat at each concentration 5 times and get the average



ResultsPlus Examiner Comments

Five marks were given. We accepted the idea of sterile equipment for aseptic technique. There are also statements about using a range of garlic concentrations, placing the extract on to paper discs, mixing bacteria with agar and details of what should be measured as the dependent variable. Putting agar on the Petri dish was not good enough for a mark and leaving for "a few hours" does not get the mark for incubation. When values were quoted we expected at least 24 hours to be stated.

*(ii) Describe an investigation to determine the effect of the concentration of garlic extract on other species of bacteria.

(6)

Pour molten but cool sterile nutrient agar on a sterile petri dish. Transfer a fixed volume of one species of bacteria using a sterile pipette and spread using a sterile spreader to get a lawn. Crush ~~10g of garlic~~ different amount of garlic eg: 5g, 10g, 2g etc. in 10cm³ of ethanol to get 1% extract. Obtain filter paper disks of same diameter and thickness using a hole puncher. ~~By opening the lid slightly~~ Soak each filter paper disk to different concentration of garlic extract, and by opening the lid slightly transfer each filter paper disk using separate sterile forceps. Incubate ~~th~~ it in a water bath at 25°C for 36 hours. The measure the diameter of the clear zone several times using a ruler. Repeat the experiment 3 times at each garlic concentration to calculate a mean and to increase reliability.



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Examiner Comments

Six marks were given. We accepted the idea of sterile equipment for aseptic technique. There are also statements about using a range of garlic concentrations, soaking paper discs in the garlic extract, making a bacterial lawn, incubating the cultures and details of what should be measured as the dependent variable.

Question 6 (b)

When comparisons were made, candidates generally scored full marks. However, the main reason for not scoring marks was that candidates did not give a comparative answer.

For example, they might have stated that Withering did not carry out tests on animals, but they did not continue and state that contemporary drug trials do involve tests on animals.

(b) Suggest **two** differences between the way William Withering would have tested garlic extract and contemporary drug trials.

(2)

1. Contemporary drug trials they tested on animals before testing on humans while William Withering tested only on humans

2. In contemporary drug trials they tested on healthy persons and patients while William Withering tested only on patients



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Examiner Comments

This candidate gained both available marks.
Correct statements about animal testing and about using healthy people were made.

(b) Suggest **two** differences between the way William Withering would have tested garlic extract and contemporary drug trials.

(2)

1. William Withering didn't have double blind trial

2. William Withering didn't test on animals before humans



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Examiner Comments

This answer gained no marks.

There are no statements about contemporary trials so the answer is not comparative.



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Examiner Tip

When answering comparison style questions it is essential to set out both sides of the comparison to be able to gain marks.

Question 7 (b)

Several candidates correctly stated that the ribosome would be the site of protein synthesis, but omitted to state that the protein would be made from the radioactive amino acids.

(b) Suggest why the levels of radioactivity increased in organelle P.

(2)

Firstly when the amino acids are taken into the cell tRNA molecules attach to the ^{radioactively labelled} amino acids and carries them to organelle P (ribosomes) ~~where~~ ^{where} they are used in translation of mRNA. The amino acids are joined by peptide bonds ~~to~~ to form a polypeptide chain in the ~~ribosom~~ ribosomes.



ResultsPlus Examiner Comments

This answer gained both marks as the reference to translation in the ribosomes is acceptable as equivalent to protein synthesis for the first mark. The use of radioactive amino acids is stated for the second mark.

(b) Suggest why the levels of radioactivity increased in organelle P.

(2)

ribosomes are site of protein synthesis. Therefore it contains a high amount of amino acids



ResultsPlus Examiner Comments

This gained one mark. The statement about protein synthesis is fine but there is no reference to the amino acids being radioactive so a second mark cannot be given.

Question 7 (c) (i)

The command word for this question was 'describe' but a number of candidates attempted to give an explanation for the changes rather than a description. Marks were often lost in this question because candidates did not give time references as they were too focussed on an explanation. This also caused candidates problems when they came to answer question 7c(ii) which did ask for an explanation. As they tried to avoid repeating the answer already given, marks were lost.

(c) (i) Describe the changes in the level of radioactivity in organelle Q. ^(amino acid) (min = minutes) (2)

⊕ As the time in minutes increases the level of radioactivity of organelle Q increases till 20 min then it decreased till 40 min.
⊕ 20 min was higher than 40 min by 75 arbitrary unit (level of radioactivity)



ResultsPlus Examiner Comments

This response gained one mark.

The first statement the candidate makes cannot be given a mark as there is no reference to a start time (5 or 10 mins).

The second statement is awarded a mark as there is a correct description of when there is a decrease in radioactivity in organelle Q.

(c) (i) Describe the changes in the level of radioactivity in organelle Q.

(2)

In the 1st 5 minutes there is no radioactivity in organelle Q. From 10 to 20 minutes the radioactivity in Q increases where the peak radioactivity of 80 is observed at 20 minutes. After 20 minutes the radioactivity begins to fall. The greatest change in radioactivity is from the 20th to the 25th minute where radioactivity decreases by 50.



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Examiner Comments

Two marks were awarded as this gives correct descriptions of both the increase and the decrease in radioactivity with suitable time references.

Question 7 (c) (ii)

Candidates were expected to refer to proteins or polypeptides in their explanations. However a number of answers referred to the movement of amino acids.

Some candidates thought that the ribosomes moved through the RER and others stated that radioactivity was transferred to the ribosome.

(ii) Explain the changes in the level of radioactivity in organelle Q.

(2)

The radioactivity is zero in the beginning because nothing is being transferred to Q. Then it starts to increase as proteins enter after being made in the ribosome. They are folded ~~there~~^{in Q} so they stay in there for some time and in this while levels increase. After its done folding it starts to send these proteins to R and level starts to decrease.



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Examiner Comments

This was awarded two marks as suitable explanations of both an increase and a decrease are given.

(ii) Explain the changes in the level of radioactivity in organelle Q.

(2)

→ ribosomes are attached to the rough endoplasmic reticulum. once the proteins are manufactured in the ribosomes they move through the rER to be further processed and folded. ~~xxxx~~ the more the proteins being processed by the rER, the more the radioactivity increases.



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Examiner Comments

This gained one mark for an explanation of why the level of radioactivity increased in the rough ER. However, there was no attempt made to explain the subsequent decrease.

Question 7 (d) (i)

The majority of candidates struggled to link the data in the question to their own knowledge. There were descriptions of the roles of the ribosomes and Golgi apparatus that were not linked to the context of the question. A commonly seen misconception was that the process of modification of the protein somehow reduced the level of radioactivity in the Golgi.

- (d) (i) Suggest why the maximum level of radioactivity in organelle **R** was lower than the maximum level of radioactivity in organelle **P**.

(2)

- Some transport vesicles didn't reach the golgi apparatus,
- Some protein doesn't need to be modified in the golgi apparatus



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Examiner Comments

Both marks were awarded. The first statement was given a mark for realising not all vesicles (containing proteins that were radioactive) may have reached the Golgi. The second statement showed this candidate understood that some proteins for intracellular use do not need to be transported to the Golgi as they would not need modification.

- (d) (i) Suggest why the maximum level of radioactivity in organelle **R** was lower than the maximum level of radioactivity in organelle **P**.

(2)

Some protein was be used by the cell like as an enzyme.



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Examiner Comments

This was awarded one mark as the answer has the idea that some proteins are for intracellular use.

Question 7 (d) (ii)

The majority of candidates gained one mark for realising the level of radioactivity would decrease. Slightly fewer gained the second mark for stating where the proteins would go.

- (ii) Suggest what will happen to the level of radioactivity in organelle **R** after 40 minutes. Give a reason for your answer.

(2)

Will decrease further as the protein will be released in the form of lysosome from the organelle R.



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Examiner Comments

Two marks were awarded. The answer indicates that there would be a decrease and so gains the first mark. We accepted lysosome as an alternative to vesicle so also awarded a second mark.

- (ii) Suggest what will happen to the level of radioactivity in organelle **R** after 40 minutes. Give a reason for your answer.

(2)

It will decrease. Because modified protein will be packaged into secretory vesicles. These will release protein out of cell by exocytosis.



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Examiner Comments

This gained two marks and is a good example of what was expected.

Question 8 (b) (i)

The idea of microbial contamination was stated by most candidates but fewer successfully described the consequences of this. Many referred to competition but did not qualify what there would be competition for. Non-specific descriptions such as 'competition for resources' were not accepted.

- (i) Explain why it is important that these techniques are carried out under aseptic conditions.

(3)

- ① To prevent growth of ~~the~~ bacteria
- ② To keep the investigation valid
- ③ If contamination takes place it will interfere with the result
- ④ Fight for nutrients will take place



ResultsPlus Examiner Comments

Only one mark was given for this response.

To prevent growth of bacteria was accepted for the idea of preventing contamination.

We did not think 'fight for nutrients' was an appropriate phrase so a second mark was not given.

- (i) Explain why it is important that these techniques are carried out under aseptic conditions.

(3)

This is to prevent microorganisms from entering the culture that can compete for resources with the *S. chinata* plants tissue culture. Also the microorganism might be pathogenic and can be harmful to humans.



ResultsPlus Examiner Comments

Two marks were awarded.

The first sentence gained a mark for the idea of preventing contamination but competition for resources was not precise enough to gain credit.

The statement at the end of the answer indicating that the bacteria could be harmful to humans gained this candidate a second mark.

Question 8 (b) (ii)

Many candidates answered this question and gained full marks. However there were a significant number who thought it was concerned with choosing the parts of the plant with the most medicinal agent.

(ii) Explain why the scientists took samples of tissue from very specific parts of the *S. chirata* plant.

Scientists choosed parts of plants which had (2)
cells which were dividing actively for
succeseful tissue culture.



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Examiner Comments

Although this was not a clearly expressed answer it gained one mark because it does indicate that the cells are capable of dividing.

(ii) Explain why the scientists took samples of tissue from very specific parts of the *S. chirata* plant.

As the cells on these specific parts are still totipotent (2)
and still undergoing mitosis. Hence, the tissue cultures
would be able to grow.



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Examiner Comments

Two marks were given as the cells are correctly described as totipotent and we accepted references to cells undergoing mitosis as equivalent to the idea that the cells are capable of dividing.

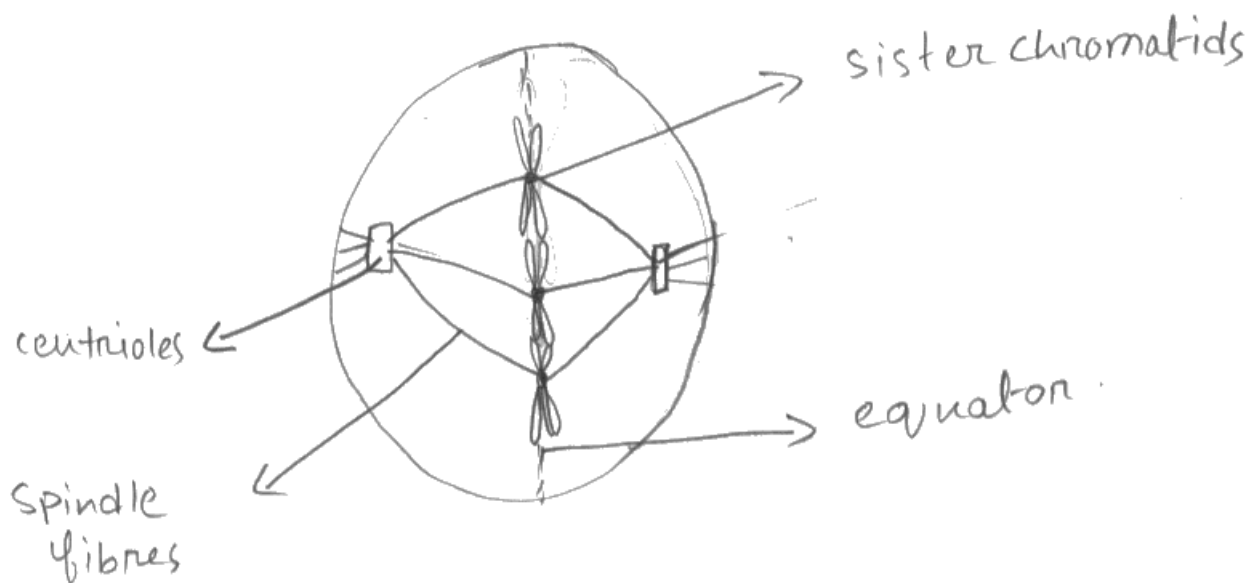
Question 8 (b) (iii)

Those candidates that read the question carefully were led into drawing a single chromosome. Others attempted to draw a whole cell at metaphase and the resulting chromosome drawings were very small; sometimes so small that labels could not be attached.

- (iii) The scientists checked the chromosomal stability of the plants they produced. They did this by counting the number of chromosomes in the cells in metaphase.

Draw and label the parts of a chromosome as it appears in metaphase.

(3)



ResultsPlus Examiner Comments

Only one mark was awarded. This was for the drawing. We ignored any details of the nuclear spindle that were drawn. The label sister chromatids was not given a mark as it is not clear which part the line is pointing to.



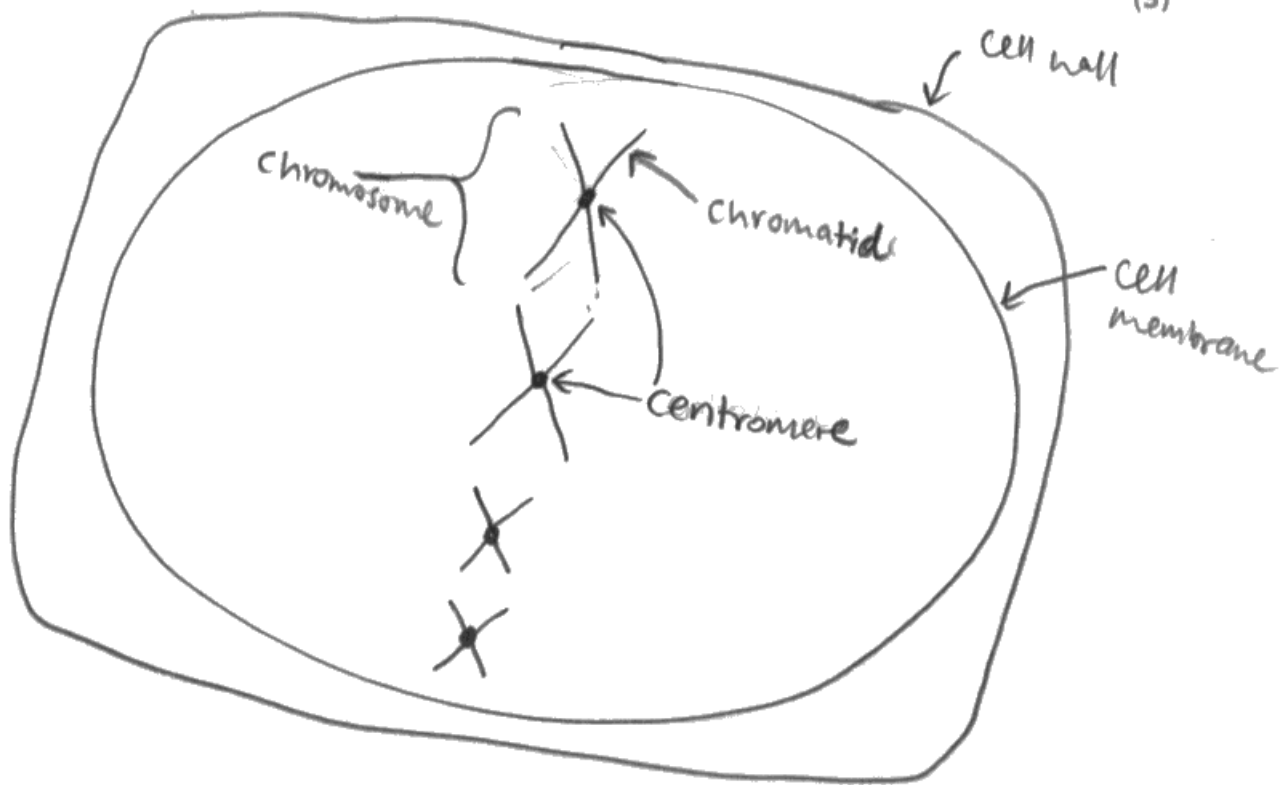
ResultsPlus Examiner Tip

Take care when labelling drawings or diagrams as it must be clear to an examiner which part the label line is pointing to.

(iii) The scientists checked the chromosomal stability of the plants they produced. They did this by counting the number of chromosomes in the cells in metaphase.

Draw and label the parts of a chromosome as it appears in metaphase.

(3)



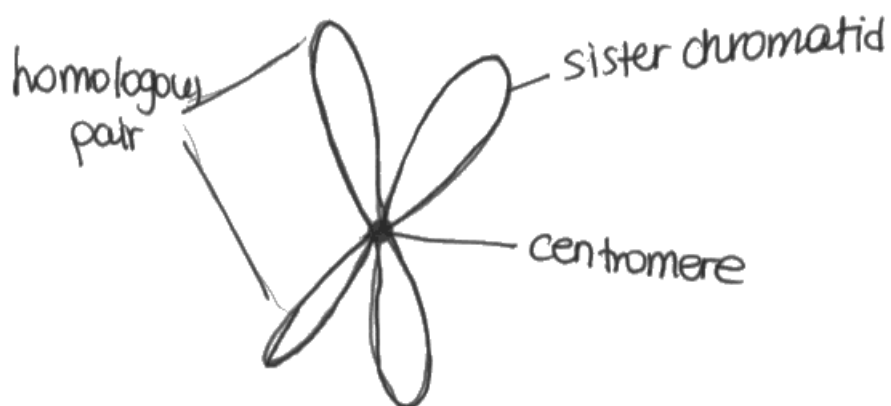
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Examiner Comments

All three marks were awarded. We ignored any details of the nuclear spindle that were drawn and we allowed 'stick' drawings of chromosomes. In this response the labels centromere and chromatids were clear enough.

(iii) The scientists checked the chromosomal stability of the plants they produced. They did this by counting the number of chromosomes in the cells in metaphase.

Draw and label the parts of a chromosome as it appears in metaphase.

(3)



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Examiner Comments

All three marks were awarded. We ignored any extra labels that were present in addition to the expected chromatid and centromere (in this case homologous pair was ignored).

Question 8 (c)

Many candidates stated the importance of storing seeds but the idea that seeds could be used to increase populations beyond the seed bank was rarely stated. Few candidates referred to the idea that seeds from the bank could be planted in the plant's natural habitat.

Candidates should note that they cannot use the word 'conserve' to explain conservation.

(c) Suggest how seedbanks could be used to help conserve this endangered plant.

(2)

This plant can be conserved in a seed bank by first extracting the seeds then they will be x-rayed so that they can conserve all their properties. These seeds will be stored at low temperatures so that they can't germinate and can be taken out to plant them at any time.



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Examiner Comments

One mark was given for the idea of storing seeds.

However, the last part of the answer does not quite have the idea of producing more plants.

(c) Suggest how seedbanks could be used to help conserve this endangered plant.

(2)

A large number of seeds is collected from different plants and stored.

This increases genetic diversity as there are more alleles present in gene pool.

Seeds in seedbank can be dried and stored at cool temperature to ensure viability

and can be stored for longer time and can be used to grow endangered plant species.



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Examiner Comments

Only one mark was given. This was for the idea of storing seeds.

A second mark was not given as the answer refers to increasing genetic diversity rather than maintaining genetic diversity.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- when asked to compare two processes, molecules or cells, remember to include a statement about both
- when labelling drawings or diagrams, make sure it is clear which part your label line is pointing to
- do not use the word you are defining to explain your answer
- when describing practical procedures, include enough precise details that would allow someone else to follow your instructions and repeat the same experiment
- read all parts of the question and take into account the context as well as the command words used

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