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Examiners' Report
June 2023

Int GCSE Biology 4BI1 2B

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Introduction

The examiners commented on the very high standard of many of the scripts. It was very clear that many candidates and centres have worked very hard to prepare for the examination. Candidates and teachers should be commended for their hard work over the last few years. Many candidates used technical language confidently and wrote answers with a level of detail commensurate of International GCSE standard. Maths skills were generally very strong and it was pleasing to see that many candidates are analysing data with skill and confidence. Practical skills are assessed on these papers and it was also clear that most candidates are able to experience practical work and have a very strong understanding of the scientific method. A few candidates found some aspects of the paper challenging. Where candidates did not gain credit, it was typically due to confusing the demands of command words (explain and describe are often confused), not giving enough depth in answers, and not using key terms. A minority of candidates also lack confidence when tackling data analysis questions. When analysing data for longer questions, candidates should identify and describe patterns in data, discuss how data supports or opposes a conclusion and comment on the quality of the experimental design (for example, is there sufficient data to draw a conclusion and is the experiment controlled). Most candidates attempted every question and few seemed to have problems completing the paper in the allocated time.

Question 1 (b)(i)

Many excellent, high quality answers were seen to this question about the reasons for growth of dinoflagellates. Strong answers explained that deforestation would lead to soil erosion and the leaching of minerals in the water, whilst agriculture would release minerals from fertiliser. Stronger answers also referred to named nutrients, such as nitrates or magnesium and the functions of these in producer growth. A common, correct answer that many candidates gave was deforestation would lead to an increase in carbon dioxide which would increase rates of photosynthesis by the dinoflagellates. Some candidates misinterpreted the information and suggested that the loss of forest would reduce competition for dinoflagellates and so cause a population increase. Candidates should also be careful to give specific nutrients such as minerals, nitrates or magnesium rather than using the vague term nutrients. Some candidates gave vague answers about biotic and abiotic factors affecting population growth rather than discussing the information in the passage.

(b) (i) Explain why intensive farming and deforestation would cause an increase in populations of dinoflagellates. (lines 9 to 11)

(3)

As forests are cut down and farms grow, fertilisers are used, which become leached into rivers when it rains. This causes an excess of nitrates which the dinoflagellates feed on and reproduce with, as they have excess energy and nutrients

ResultsPlus
Examiner Comments

This excellent answer gained three marks. The answer states that fertiliser is leached into the water and names nitrates as a nutrient.

ResultsPlus
Examiner Tip

Always give specific examples of nutrients such as nitrates.

(b) (i) Explain why intensive farming and deforestation would cause an increase in populations of dinoflagellates. (lines 9 to 11)

(3)

Increase in Carbon dioxide allowing dinoflagellats to photosynthesis at quicker rate, so produce more energy. therefore can have larger reproduce more children/offspring Intensive farming would mean less competition for food, easier to get food and grow more so less eaten by predators more population

ResultsPlus
Examiner Comments

This answer gained one mark for the reference to increased carbon dioxide for photosynthesis. No reference is made to the leaching of minerals.

(b) (i) Explain why intensive farming and deforestation would cause an increase in populations of dinoflagellates. (lines 9 to 11)

(3)

As intensive farming and deforestation cause leaching and so surface runoff, ✓ increasing the nutrients such as nitrate in ocean. These nitrates, magnesium and other nutrients build chloroplasts and amino acids which aid in photosynthesis. Since they photosynthesise, they produce glucose molecules for respiration which releases energy in the form of ATP and help these dinoflagellates survive. Since they live longer, they produce more offspring increasing population.

ResultsPlus
Examiner Comments

This excellent answer gained three marks. Leaching is explained and nitrates and magnesium are given as examples of nutrients. A function of the nitrates is also given.

(b) (i) Explain why intensive farming and deforestation would cause an increase in populations of dinoflagellates. (lines 9 to 11)

(3)

~~less farming~~ Farming and deforestation causes the amount of carbon dioxide in the atmosphere to increase. More farming and deforestation will increase the ~~co~~ CO_2 in the atmosphere. The dinoflagellates will photosynthesize more due to the ~~increased~~ increased concentration of carbon dioxide. More glucose is produced which leads to more respiration. This leads

ResultsPlus
Examiner Comments

This answer gains one mark as the candidate has correctly stated that there will be more carbon dioxide for photosynthesis.

Question 1 (b)(ii)

Most candidates were able to gain at least one mark on this question with many going on to gain a second. Many candidates appreciated that respiration by the algae or by decomposer organisms would reduce the oxygen. Fewer candidates stated that decomposer organisms are microorganisms such as bacteria and fungi. Candidates should always give specific detail in answers, eg referring to decomposer bacteria rather than decomposer organisms. A number of candidates also correctly recognised that the lack of photosynthesis by dinoflagellates would reduce oxygen. A number of candidates incorrectly stated that increased photosynthesis would lead to reduced oxygen.

(ii) **Explain why oxygen levels decrease after a series of glowing events. (lines 10 to 13)**

(2)

Many species of dinoflagellates photosynthesise, so if they die, the oxygen levels decrease as photosynthesis produces oxygen

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that reduced photosynthesis would lead to less oxygen release.

(ii) Explain why oxygen levels decrease after a series of glowing events.
(lines 10 to 13)

(2)

Bacteria ~~etc~~ will decompose the dinoflagellates. These bacteria aerobically respire, which decreases the oxygen levels in the water

ResultsPlus
Examiner Comments

This answer gained two marks for correctly referring to bacteria and the process of decomposition / respiration.

ResultsPlus
Examiner Tip

Always refer to bacteria or fungi when describing decomposition.

(ii) Explain why oxygen levels decrease after a series of glowing events.
(lines 10 to 13)

(2)

The ~~pr~~ protoctists respire, using up oxygen in the process. more to create more ATP

ResultsPlus
Examiner Comments

This answer gained one mark for the idea of respiration by the protoctists.

Question 1 (d)(i)

This maths question required candidates to calculate the mean rate of consumption of the dinoflagellates by copepods. Most were able to complete the calculation and gain two marks. Where candidates did not gain two marks, it was typically for only dividing by 15 or by 2 instead of both.

(d) (i) Each of the 15 copepods ate glowing dinoflagellates at a mean rate of 40 dinoflagellates per hour.

Calculate the mean rate at which each copepod ate dinoflagellates that were not glowing. (lines 18 to 21)

(2)

$$\frac{2100 - 1200}{1200} = 0.75 \times 15$$

$$= 11.25$$

mean rate = 11.25 dinoflagellates per hour

ResultsPlus
Examiner Comments

This answer gained no marks as there is no division by 15 or 2.

(d) (i) Each of the 15 copepods ate glowing dinoflagellates at a mean rate of 40 dinoflagellates per hour.

Calculate the mean rate at which each copepod ate dinoflagellates that were not glowing. (lines 18 to 21)

(2)

15 , 2hours ⇒ glowing = 1200 → 1 hour = 600

15 , 2hours ⇒ X glowing = 2100 → 1 hour = 1050

1 hour

glow : X glow

600 : 1050

40 : ?

⇒ 1295

70 140

mean rate = 140 dinoflagellates per hour

ResultsPlus
Examiner Comments

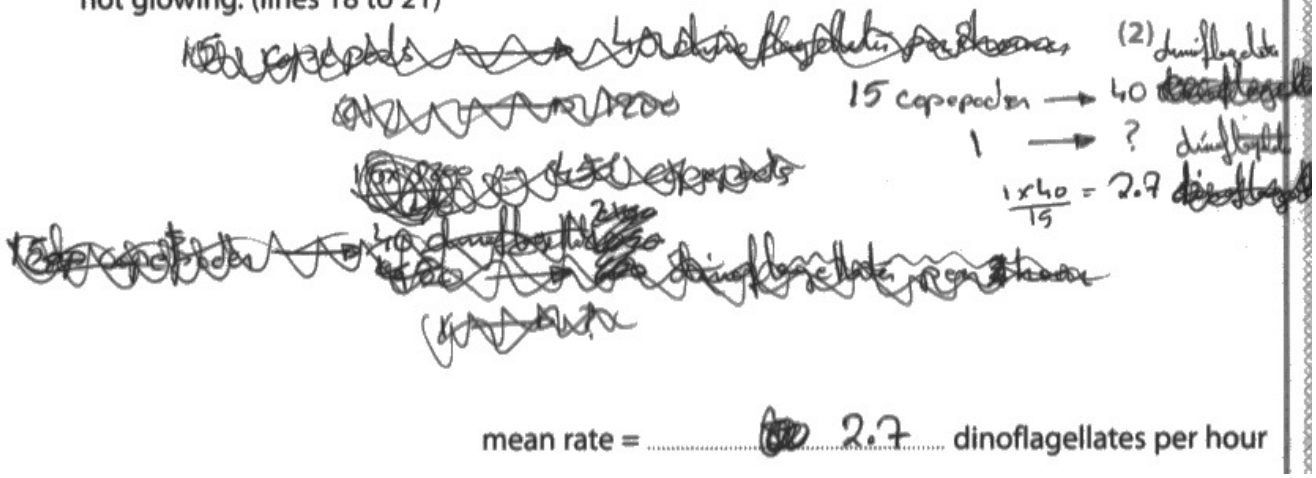
This answer gained one mark as there is a division of 2100 by two hours to give 1050 in the working.

ResultsPlus
Examiner Tip

Always show your working when completing calculations.

(d) (i) Each of the 15 copepods ate glowing dinoflagellates at a mean rate of 40 dinoflagellates per hour.

Calculate the mean rate at which each copepod ate dinoflagellates that were not glowing. (lines 18 to 21)



mean rate = 2.7 dinoflagellates per hour

ResultsPlus
Examiner Comments

This answer gained one mark for a correct division by 15.

(d) (i) Each of the 15 copepods ate glowing dinoflagellates at a mean rate of 40 dinoflagellates per hour.

Calculate the mean rate at which each copepod ate dinoflagellates that were not glowing. (lines 18 to 21)

(2)

$\frac{2100}{2} = 1050$

$\frac{1050}{15} = 70$

mean rate = 70 dinoflagellates per hour

ResultsPlus
Examiner Comments

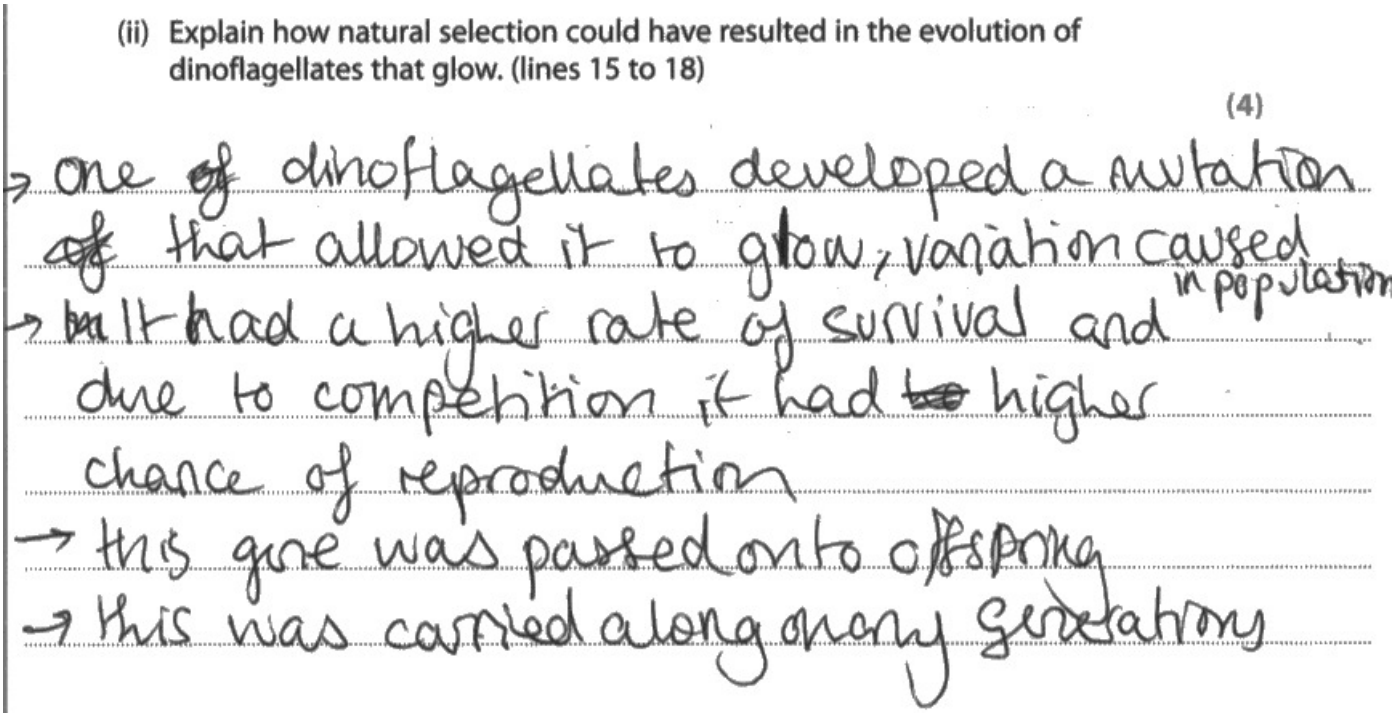
This answer gained two marks for a correct answer of 70. The two division are also given clearly in the working.

Question 1 (d)(ii)

Many excellent answers were seen to this question about natural selection. Most candidates recognised that mutation will have produced a gene for glowing that leads to better survival of dinoflagellates, increased reproduction and passing on of the allele to the next generation. Some candidates recognised that the glowing trait would lead to less consumption of the dinoflagellates but did not go on to give any more detail. Candidates should always try to give as much detail as possible and think carefully where mark points may be awarded.

(ii) Explain how natural selection could have resulted in the evolution of dinoflagellates that glow. (lines 15 to 18)

(4)



ResultsPlus
Examiner Comments

This excellent answer gained all four marks. The answer clearly states that a mutation has created variation that has led to better survival and reproduction. The answer then goes on to correctly state that the gene is passed to the offspring.

ResultsPlus
Examiner Tip

Use key, scientific terms in your answers, for example, survival, mutation and passing on alleles.

(ii) Explain how natural selection could have resulted in the evolution of dinoflagellates that glow. (lines 15 to 18)

(4)

Because their glow is what stops predators from eating them, more glowing dinoflagellates that glow survived than those that don't glow. These then continued to reproduce until glowing became a common characteristic and increased their overall population survival.

ResultsPlus
Examiner Comments

This answer gained two marks. The second line states that the dinoflagellates survive and then on the third line it states that they are able to reproduce. No other mark points are given.

(ii) Explain how natural selection could have resulted in the evolution of dinoflagellates that glow. (lines 15 to 18)

(4)

One dinoflagellate had a mutation (a rare, random change in genetic material that can be inherited) to ~~the~~ give it the ability to glow. This dinoflagellate then had an advantage over other dinoflagellates, meaning that the mutated one survived. This mutated one then reproduced, passing the mutated allele onto its offspring. Then, these offspring survived as a result and then passed their alleles with the glowing mutation onto their offspring. This carried on across multiple generations until all dinoflagellate could glow.

ResultsPlus
Examiner Comments

This excellent answer gained four marks. The answer correctly states that a mutation gives the dinoflagellates a survival advantage, leading to reproduction and passing on the allele to the offspring.

Question 1 (e)

This question required candidates to suggest why use of dinoflagellates in street lighting would reduce pollution. Some excellent answers were seen that explained that less electricity would be used so that less fossil fuels would be burnt, thus leading to a reduction in carbon dioxide release. Some candidates recognised that there would be less electricity but did not go further in their answer to explain why this would lead to less pollution. Many candidates correctly stated that the dinoflagellates would remove carbon dioxide due to photosynthesis. In future series, candidates should be encouraged to refer to reduction of carbon dioxide rather than simply stating carbon neutral / removal of carbon / having a lower carbon footprint.

(e) Explain why using dinoflagellates for street lighting would help to reduce pollution. (lines 22 to 26)

(3)

electricity is provided by burning fossil fuels that release ~~harmful~~ harmful gases into the atmosphere, such as smoke and carbon dioxide. the dinoflagellates would remove the need to burn fossil fuels, reducing the pollution in the air. ✓

as they do not rely on mains electricity energy to run, only battery power.

ResultsPlus
Examiner Comments

This strong answer gained three marks. The candidate has correctly stated that there would be less need for electricity, less fossil fuel burning and so less carbon dioxide release.

(e) Explain why using dinoflagellates for street lighting would help to reduce pollution. (lines 22 to 26)

(3)

They can make light naturaly, and don't need batteries or electricity. They photosynthesise which produces ~~release~~ oxygen. They make their own energy, so it doesn't need to be made using things that are bad for the environment.

ResultsPlus
Examiner Comments

This answer gained two marks for the idea that there would be less need for electricity and that the dinoflagellates photosynthesise. No credit was given for the oxygen release.

(e) Explain why using dinoflagellates for street lighting would help to reduce pollution. (lines 22 to 26)

(3)

because they are a natural source of light and don't require any non-renewable resources to be burnt, like fossil fuels, this means that we won't be producing as much carbon emissions so we're not adding to air pollution

ResultsPlus
Examiner Comments

This answer was awarded two marks for the reduced burning of fossil fuels and the reduction of carbon emissions. The term 'reduced carbon emission' was accepted but it would be better if the candidate had stated that there was reduced release of carbon dioxide gas.

ResultsPlus
Examiner Tip

Refer to carbon dioxide release rather than carbon emission.

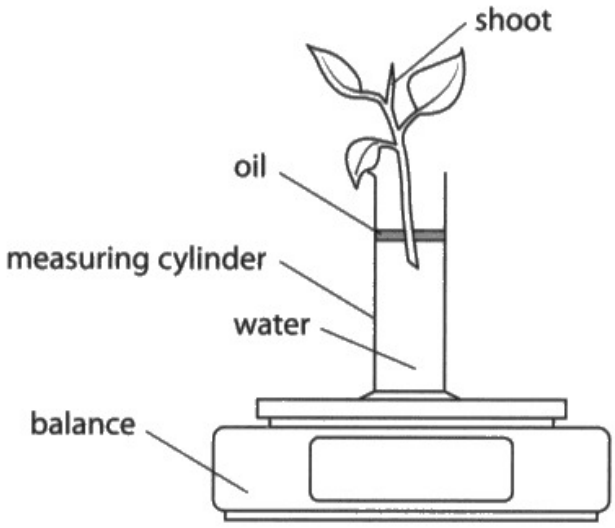
Question 2 (a)

This question was about an experiment to investigate water loss and water uptake by a plant shoot. In this first part, candidates were asked to give a reason for placing oil over the water surface. Around half of the candidates recognised that the oil would prevent evaporation, but a significant number confused the role of the oil with the role of the oil when investigating anaerobic respiration in yeast (suggesting that it prevented oxygen entry).

2 A student uses this method to investigate water uptake and water loss by a plant shoot.

- pour 100 cm^3 of water into a measuring cylinder
- place a plant shoot into the measuring cylinder
- cover the surface of the water with oil
- place the measuring cylinder and plant shoot on a balance and record the total mass
- shine light on the plant shoot using a lamp
- record the volume of the water in the measuring cylinder after four days, and after eight days
- record the total mass of the measuring cylinder and plant shoot after four days, and after eight days

The diagram shows the student's apparatus.



(a) State the reason for using the oil.

(1)

To prevent the water from evaporating

ResultsPlus
Examiner Comments

This is a correct answer that gained one mark.

ResultsPlus
Examiner Tip

Have a full understanding of all the core practicals listed in the specification.

2 A student uses this method to investigate water uptake and water loss by a plant shoot.

- pour 100 cm^3 of water into a measuring cylinder
- place a plant shoot into the measuring cylinder
- cover the surface of the water with oil
- place the measuring cylinder and plant shoot on a balance and record the total mass
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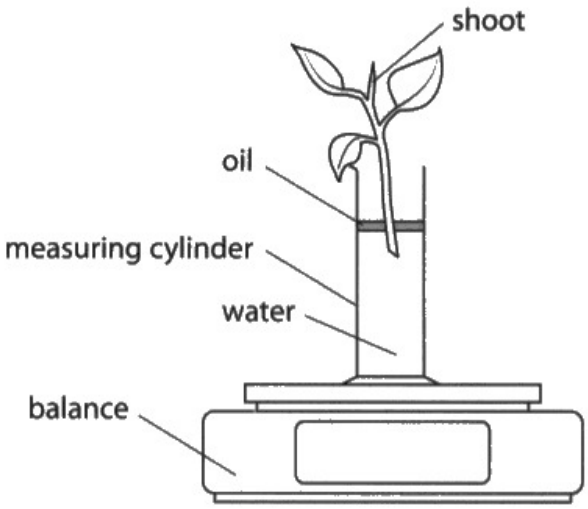

(a) State the reason for using the oil.

(1)

To prevent oxygen from entering and forming air bubbles affecting the water uptake rate

ResultsPlus
Examiner Comments

This is an example of a common incorrect answer where the candidate has confused this experiment with an investigation into anaerobic respiration of yeast.

Question 2 (b)(i)

This question was a mathematical calculation. Most candidates were able to gain at least one mark with many gaining both. Candidates were required to calculate the mean rate of water loss by subtracting the final volume of water from the starting volume and dividing by the time taken. Some candidates confused the term 'mean rate' and tried to calculate an average.

(b) The table shows the student's results.

	Volume of water in measuring cylinder in cm^3	Total mass of measuring cylinder and plant shoot in g
start (day 1)	100	175
day 4	75	165
day 8	65	155

(i) The volume of water taken up by the plant shoot is equal to the change in volume of water in the measuring cylinder. This is called the water uptake.

Calculate, in cm^3 per day, the mean rate of water uptake by the plant shoot during the eight days.

(2)

100 - 65 = 35 in 8 days

35 ÷ 8 = 4.36

mean rate = 4.36 cm^3 per day

ResultsPlus
Examiner Comments

This answer gained one mark. The first part of the calculation is correct (35) but the division is incorrect.

(b) The table shows the student's results.

	Volume of water in measuring cylinder in cm^3	Total mass of measuring cylinder and plant shoot in g
start (day 1)	100	175
day 4	75	165
day 8	65	155

(i) The volume of water taken up by the plant shoot is equal to the change in volume of water in the measuring cylinder. This is called the water uptake.

Calculate, in cm^3 per day, the mean rate of water uptake by the plant shoot during the eight days.

(2)

$$\frac{100-65}{\frac{(100+75+65)}{8}} = 30 \quad 4.375$$

mean rate = 4.375 / ~~30~~ cm^3 per day

ResultsPlus
Examiner Comments

This answer gained two marks for a correct answer. The working is clearly shown – an example of good practice.

ResultsPlus
Examiner Tip

Always show your working clearly – you may still get marks even if the final answer is wrong.

(b) The table shows the student's results.

	Volume of water in measuring cylinder in cm^3	Total mass of measuring cylinder and plant shoot in g
start (day 1)	100	175
day 4	75	165
day 8	65	155

(i) The volume of water taken up by the plant shoot is equal to the change in volume of water in the measuring cylinder. This is called the water uptake.

Calculate, in cm^3 per day, the mean rate of water uptake by the plant shoot during the eight days.

(2)

100 - 65 = 35

35 ÷ 8 = 4.375

mean rate = 4.375 cm^3 per day

ResultsPlus
Examiner Comments

This answer also gained both marks and has clear working.

Question 2 (b)(ii)

This question generated an excellent range of answers. Many candidates correctly recognised that over the first four days, more water was taken up than lost. Strong answer included a relevant calculation to support their answer and then pointed out that some of the water would be retained within the plant for turgor in cells or used in photosynthesis. Few candidates went on to state that the rate of water uptake and loss was the same between day four and day eight. Many candidates correctly stated that the water is lost through stomata or by transpiration. Weaker answers often only described one of the data series and did not recognise that more water must have been taken up than lost. Candidates should explore data as fully as possible, looking for all trends and patterns.

(ii) **Comment on the changes in total mass of the measuring cylinder and plant shoot, compared with the changes in volume of water in the measuring cylinder.**

[1 cm^3 of water has a mass of 1 g]

(4)

The total mass of the measuring cylinder and plant shoot decreases by 20g, while the volume of water in the measuring cylinder decreased more by 35 cm^3. This is because some of the water uptake from the water in the measuring cylinder is pulled up the xylem to the leaves due to the transpiration stream, which means water is continuously lost to the environment due to transpiration and the diffusion of water vapour out of the leaves. This means that the decrease in total mass of the measuring cylinder and the plant shoot is less than the water uptake, because not all water ~~ha~~ is retained in the plant as some water is lost via transpiration.

ResultsPlus
Examiner Comments

This excellent answer gained four marks for correctly stating that both mass and volume decrease, that the volume decreases more and supports this with a calculation. The candidate also explains that water is retained and that some is lost by transpiration.

(ii) Comment on the changes in total mass of the measuring cylinder and plant shoot, compared with the changes in volume of water in the measuring cylinder.

[1 cm^3 of water has a mass of 1 g]

(4)

Both the increased the total mass of the measuring cylinder and the volume of water decreased. This means that as the plant took up water it also lost water by the plant shoot. But, the plant took up more water than it lost.

ResultsPlus
Examiner Comments

This answer gained two marks for correctly stating that both decrease but that there is a higher decrease in volume than mass.

(ii) Comment on the changes in total mass of the measuring cylinder and plant shoot, compared with the changes in volume of water in the measuring cylinder.

[1 cm^3 of water has a mass of 1 g]

(4)

In the first 4 days while the water had a 25 cm^3 decrease the mass only decreased by 10 g. From day 5 to day 8 both the volume of the water and the mass had the same decrease of 10 cm^3 and 10 g.

ResultsPlus
Examiner Comments

This answer is a good example from a candidate who has recognised the patterns. Marks are awarded for both decreasing, a correct calculation, the idea that volume decreases more than mass, and that the decrease is the same eventually.

(ii) Comment on the changes in total mass of the measuring cylinder and plant shoot, compared with the changes in volume of water in the measuring cylinder.

[1 cm^3 of water has a mass of 1 g]

(4)

The total mass of the cylinder decreased by 10g after each ~~for~~ four days, however the volume of water decreased more (by 25g) after 4 days then 10 after 8. That's ~~because~~ because the water is used for photosynthesis while mass ~~rat~~ rarely changes.

ResultsPlus
Examiner Comments

This answer gained four marks. The candidate recognises that both mass and volume decrease and that the decrease in volume is greater. Calculations are used to support the answer and there is a statement that some water is used in photosynthesis.

(ii) Comment on the changes in total mass of the measuring cylinder and plant shoot, compared with the changes in volume of water in the measuring cylinder.

[1 cm^3 of water has a mass of 1 g]

(4)

The reduction of mass in the measuring cylinder and plant shoot is less than the Volume of water lost over the 8 day period. One reason for this is that some of the water may have evaporated, which would cause a reduction in water volume, but not a change in system mass (which is concordant with the student's results). Another cause is that some of the water may have been taken up by the plant, but stored in its cells (whilst turgid) and not lost by transpiration. This would cause a ~~less~~ reduction in water volume but not a mass loss (as the water's mass is in the plant), similarly to the student's results.

ResultsPlus
Examiner Comments

This excellent answer gained four marks. There is a clear statement that both volume and mass decrease and that the volume decreases more. The candidate also states that water is lost by transpiration and that some water is retained within the cells.

Question 2 (c)

This question asked candidates to explain how the rate of water loss would change if a fan were placed in front of the leaf. Many candidates recognised that the rate of water loss would increase as the fan would blow water away from the leaf. Stronger answers went on to explain that the diffusion gradient would be maintained. It is important that candidates use key terminology such as the maintenance of a diffusion gradient. A few answers incorrectly stated that the rate of water loss would decrease due to the leaf being cooled.

(c) Explain why the rate of water loss would be different if a working fan is placed in front of the plant shoot.

(3)

when fan is kept, the rate of water loss increases because water particles will move faster so a higher concentration gradient (→ so water particles diffuse out quickly at a higher) takes place quickly. As the water rate particles near the stomata of the leaf is blown away the rate of transpiration increases as wind speed increases water particles are lost faster.

ResultsPlus
Examiner Comments

This answer gained three marks. There is a clear statement that the rate increases and this is explained by stating that the water molecules are blown away thus increasing the concentration gradient.

(c) Explain why the rate of water loss would be different if a working fan is placed in front of the plant shoot.

(3)

The rate of water loss from the plant would be increased if a fan was placed in front of it as wind increases the rate of transpiration. It tends to remove any water present on the surface of the leaf which increases the concentration gradient and allows water to leave the leaf via stomata in the form of water vapours.

(Total for Question 2 = 10 marks)

* The overall water lost from the measuring cylinder is more as compared to the reduction in the mass of the cylinder and the plant shoot.

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Examiner Comments

This is an example of a response that gained three marks for stating that there is an increase in rate of water loss, this is due to the water being blown away, and a reference to an increased concentration gradient.

(c) Explain why the rate of water loss would be different if a working fan is placed in front of the plant shoot.

(3)

There will be more water loss as more transpiration. Due to more wind water droplets evaporate. Faster loss in water will be observed.

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that the rate of water loss would increase. No statement about the wind removing the water or any reference to a gradient are given.

Question 3 (b)(i)

This question required candidates to convert units and calculate the area of a circle when given the formula. Most candidates were able to complete the calculation correctly and gain two marks. Some candidates did not convert the units correctly and a common error was to multiply the radius by 1000 instead of dividing.

(b) The hollow space inside a blood vessel is called the lumen.

(i) The blood vessel labelled X has a lumen with a radius of 100 µm.

Use this formula to calculate the cross-sectional area, in mm^2, of the lumen of this blood vessel.

$$\text{area of circle} = \pi \times (\text{radius})^2$$

[$\pi = 3.14$]

[1 mm = 1000 µm]

(2)

100 µm = 0.1 mm

0.1 mm = diameter

0.05 = radius

$\pi r^2 = 7.85 \times 10^{-3}$

cross-sectional area = 7.85×10^{-3} mm^2

ResultsPlus Examiner Comments

This answer gained one mark for a correct unit conversion in the working.

ResultsPlus Examiner Tip

Check that you know how to convert between different units before the exam.

(b) The hollow space inside a blood vessel is called the lumen.

(i) The blood vessel labelled X has a lumen with a radius of 100 μm.

Use this formula to calculate the cross-sectional area, in mm^2, of the lumen of this blood vessel.

$$\text{area of circle} = \pi \times (\text{radius})^2$$

[$\pi = 3.14$]

[1 mm = 1000 μm]

(2)

$\pi \times 0.1^2$

cross-sectional area = 0.0314 mm^2

ResultsPlus
Examiner Comments

This answer gained both marks for a correct final answer.

Question 3 (b)(ii)

Many candidates found this question challenging. The question asked candidates to explain why there was a difference in diameter of the two blood vessels either side of the glomerulus. Stronger answers explained that this would create the high pressure needed to force the filtrate through the glomerulus into the Bowman's capsule by ultrafiltration. A significant number of candidates simply described the structures of arteries in terms of thick, elastic walls. The question referred to the role of the difference in diameters in relation to the function of the kidney.

(ii) The lumen of blood vessel X is wider than the lumen of blood vessel Y.

Explain why this difference in the width of the lumen of the two blood vessels is important for kidney function.

(2)

In order for ultrafiltration to take place in the glomerulus the pressure of the blood has to increase so smaller or middle molecules are 'pushed' - filtered - out. Decreasing the lumen of the blood vessel increases the pressure of the blood inside.

ResultsPlus
Examiner Comments

This answer gained two marks for explaining that role of ultrafiltration in moving small molecules through the glomerulus.

(ii) The lumen of blood vessel X is wider than the lumen of blood vessel Y.

Explain why this difference in the width of the lumen of the two blood vessels is important for kidney function.

(2)

if the lumen is slimmer, the blood pressure is higher, meaning the blood enters the kidney at a high pressure, ~~this means~~ if its wider, the blood containing ~~molecules~~ nutrients can be reabsorbed

ResultsPlus
Examiner Comments

This answer gained one mark for stating that the pressure would be high.

(ii) The lumen of blood vessel X is wider than the lumen of blood vessel Y.

Explain why this difference in the width of the lumen of the two blood vessels is important for kidney function.

(2)

Blood vessel X needs to be wider because it carries unfiltered blood, which can contain larger things. The blood that leaves through vessel Y is filtered, so the lumen can be smaller and it will not affect blood flow.

ResultsPlus
Examiner Comments

This answer gained no marks. The answer almost gained a mark for the idea of small substances leaving but retaining large substances but there is no mention of the glomerulus or Bowman's capsule.

ResultsPlus
Examiner Tip

Always use key terms such as glomerulus and Bowman's capsule in your answers.

(ii) The lumen of blood vessel X is wider than the lumen of blood vessel Y.

Explain why this difference in the width of the lumen of the two blood vessels is important for kidney function.

(2)

As this allows ultrafiltration to occur as blood is able to move at a high pressure to force out urea and mineral ions in the blood.

ResultsPlus
Examiner Comments

This answer gained two marks for the role of high pressure in ultrafiltration.

Question 3 (c)

This question asked for a description of the biochemical test for protein and was well answered by most candidates. The majority were able to name Biuret solution and the correct colour change of lilac / purple. A few candidates gave the wrong solution or colour change.

(c) Protein is often found in the urine of people who have high blood pressure. elastic fibres.

Describe how urine could be tested for protein.

(2)

Add Biuret solution, gently heat and if it turns from blue to purple, protein are present

ResultsPlus
Examiner Comments

This is an example of a correct response that gained both marks for biuret solution and a purple colour.

(c) Protein is often found in the urine of people who have high blood pressure.

Describe how urine could be tested for protein.

(2)

Add urine to a test tube and deep add a few drops of Benedicts solution. If the solution turns lilac, protein is present.

ResultsPlus
Examiner Comments

This answer gained one mark. The solution used is incorrect (Benedict's) but the colour change is correct (lilac).

Question 4 (a)(ii)

This question asked for an explanation of the way that the spongy mesophyll is adapted so that leaves can photosynthesise. Most candidates were able to gain at least one mark with many going on to gain all three. Many answers gave excellent explanations of how the spongy mesophyll has air spaces to allow diffusion of gases and a few mentioned how the xylem brings water into the leaf. A few candidates confused the gases used in photosynthesis and respiration, suggesting that the leaf needs oxygen for photosynthesis.

(ii) Explain how part Q is adapted for photosynthesis in the leaf.

(3)

Part Q is called the palisade mesophyll layer. This has lots of air spaces to allow the diffusion of gases.

ResultsPlus Examiner Comments

This answer gained two marks. The name of the tissue is incorrect but there is an explanation of the role of air spaces in the diffusion of gases.

(ii) Explain how part Q is adapted for photosynthesis in the leaf.

(3)

Has lots of air spaces for gas to easily diffuse through the leaf. Cells are unevenly shaped to increase surface area. Palasade cells have lots of chloroplasts for photosynthesis.

ResultsPlus Examiner Comments

This answer gained two marks for the presence of air spaces for diffusion. The references to palisade cells and chloroplasts are not relevant in this question.

(ii) Explain how part Q is adapted for photosynthesis in the leaf.

(3)

Spongy mesophyll layer, ~~it~~ it is irregularly shaped, ~~the~~ which ~~have~~ have a large surface area for gas ~~exchange~~ exchange and movement. It also has many air gaps for gas movement. Photosynthesis require CO_2 and release O_2, therefore help photosynthesis. Xylem brings water, ~~and phloem brings sugar and amino acid~~ photosynthesis require water. $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

ResultsPlus
Examiner Comments

This answer gains all three marks. The tissue is correctly named as the spongy mesophyll and the presence of air spaces is noted. There are references to the need for carbon dioxide for photosynthesis and the presence of xylem for water movement.

(ii) Explain how part Q is adapted for photosynthesis in the leaf.

(3)

The spongy mesophyll layer has some chloroplasts allowing light energy to be able to convert into chemical energy; air spaces allows the diffusion of gases (oxygen and carbon dioxide); transparent allowing light through layer maximising photosynthesis.

ResultsPlus
Examiner Comments

This answer gained three marks for naming the tissue as the spongy mesophyll and explaining the role of air spaces in the diffusion of gases. Carbon dioxide for photosynthesis would not be given as it is not clear if the gas used in photosynthesis is oxygen or carbon dioxide.

Question 4 (b)(i)

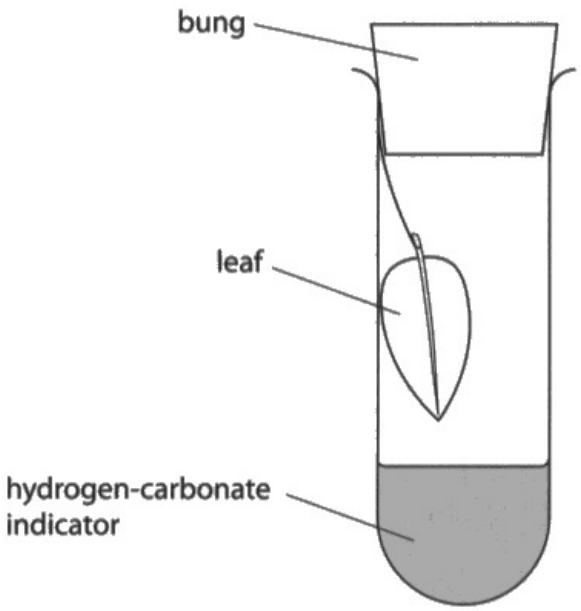
This question required candidates to identify the independent variable in an experiment investigating the effect of temperature on gas exchange. Most were able to correctly name the temperature although a number of candidates confused the independent variable with the dependent variable or even control variables.

(b) A student uses this method to investigate the effect of temperature on the rate of gas exchange in leaves.

- pour 10 cm^3 of hydrogen-carbonate indicator into each of six test tubes
- hang a leaf in five of the test tubes
- place a bung in each test tube
- place the five tubes with leaves into separate water baths at temperatures of 15 °C, 20 °C, 25 °C, 30 °C, 35 °C, and 40 °C
- place the tube with no leaf in a water bath at 25 °C
- place all tubes in bright sunlight
- record the time taken for each of the hydrogen-carbonate indicator solutions to change from orange to red

The student repeats the experiment two more times.

The diagram shows one of the tubes with a leaf.



(i) State the independent variable.

(1)

The amount of hydrogen-carbonate indicator

ResultsPlus
Examiner Comments

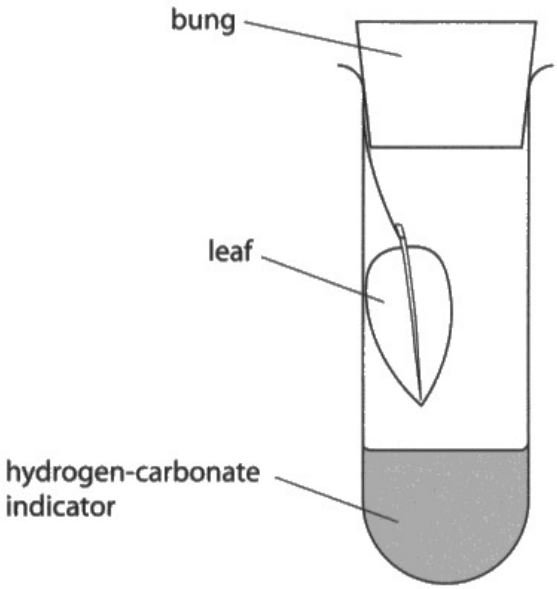
This is an example of a common incorrect answer – the amount of hydrogen-carbonate indicator which is a control variable (although therm amount is too vague).

(b) A student uses this method to investigate the effect of temperature on the rate of gas exchange in leaves.

- pour 10 cm^3 of hydrogen-carbonate indicator into each of six test tubes
- hang a leaf in five of the test tubes
- place a bung in each test tube
- place the five tubes with leaves into separate water baths at temperatures of 15 °C, 20 °C, 25 °C, 30 °C, 35 °C, and 40 °C
- place the tube with no leaf in a water bath at 25 °C
- place all tubes in bright sunlight
- record the time taken for each of the hydrogen-carbonate indicator solutions to change from orange to red

The student repeats the experiment two more times.

The diagram shows one of the tubes with a leaf.



(i) State the independent variable.

(1)

Temperature or ~~room temperature~~ the temperature water baths that each tubes is in, corresponds temperature of each test tube

ResultsPlus
Examiner Comments

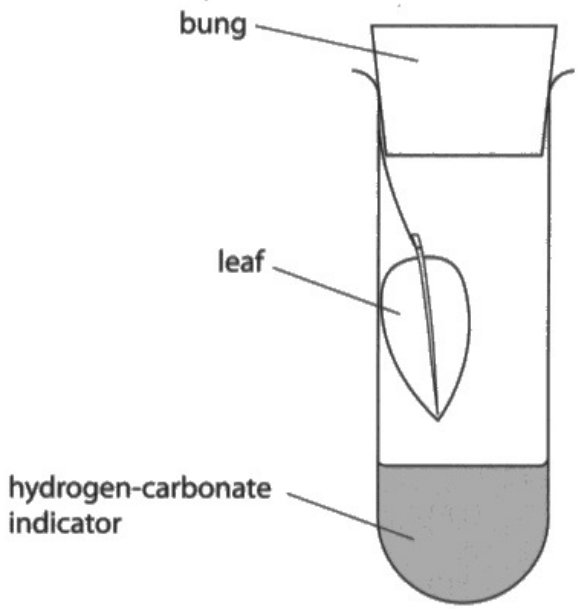
This answer gained one mark for correctly naming the temperature as the independent variable.

(b) A student uses this method to investigate the effect of temperature on the rate of gas exchange in leaves.

- pour 10 cm^3 of hydrogen-carbonate indicator into each of six test tubes
- hang a leaf in five of the test tubes
- place a bung in each test tube
- place the five tubes with leaves into separate water baths at temperatures of 15 °C, 20 °C, 25 °C, 30 °C, 35 °C, and 40 °C
- place the tube with no leaf in a water bath at 25 °C
- place all tubes in bright sunlight
- record the time taken for each of the hydrogen-carbonate indicator solutions to change from orange to red

The student repeats the experiment two more times.

The diagram shows one of the tubes with a leaf.



(i) State the independent variable.

(1)

Temperature

ResultsPlus
Examiner Comments

This seems a rather minimalist answer but it is correct so gains the mark.

Question 4 (b)(ii)

This question required candidates to identify a factor that would need to be kept constant and explain the reason for keeping it constant. Most candidates were able to correctly name a factor such as light or concentration of hydrogen-carbonate indicator and many of these went on to give correct reasons. Some candidates found the question challenging and suggested factors such as temperature (which is the independent variable) or factors that had already been listed in the question, such as species of leaf. Some candidates gave simplistic explanations such as 'to allow a fair test' – an explanation of what a fair test is in the context of the question should be given.

(ii) The species and size of leaf were the same in each tube.

Give a reason for controlling one other named factor.

(2)

factor

light intensity

reason

because photosynthesis, which takes up CO_2, requires light and the higher the light intensity, there is the more photosynthesis occurs

ResultsPlus
Examiner Comments

This correct answer gained both marks. Light intensity is given as the controlled factor and is correctly explained.

(ii) The species and size of leaf were the same in each tube.

Give a reason for controlling one other named factor.

(2)

factor

volume of indicator

reason

less indicator may change colour faster

ResultsPlus Examiner Comments

This answer gained two marks for giving a correct factor and explanation. Note that the candidate has correctly written 'volume of indicator' rather than amount.

(ii) The species and size of leaf were the same in each tube.

Give a reason for controlling one other named factor.

(2)

factor

~~carbon dioxide concentration~~ temperature

reason

ensure leaf works at optimum temperature and it doesn't denature · shows that it's not the limiting factor

ResultsPlus Examiner Comments

This is an example of a typical incorrect answer. The factor is suggested to be temperature which is the independent variable and not a control variable.

Question 4 (b)(iii)

This question tested candidates' understanding of the scientific method and the need for controls to compare results with. Most were able to correctly describe the tube with no leaf as a control experiment.

(iii) State the function of the tube with no leaf. (1)

~~used~~ It is used as a control to compare with ~~test~~ the other test tubes

ResultsPlus Examiner Comments

This is an example of a correct answer that gained the mark.

(iii) State the function of the tube with no leaf. (1)

to show there is no colour change without the leaf

ResultsPlus Examiner Comments

This is a correct answer that explains that the tube with no leaf shows that there is no colour change without the leaf.

(iii) State the function of the tube with no leaf.

(1)

As a control as it will show the hydrogen-carbonate indicator doesn't change colour by itself.

ResultsPlus
Examiner Comments

This is an excellent answer that states that the tube is a control experiment and why it is used.

Question 4 (c)(i)

This question tested mathematical skills of calculating means and giving answers to significant figures. Most candidates were able to correctly calculate a mean and go on to give two significant figures. A few candidates gave two decimal places rather than two significant figures – candidates should make sure that they are familiar with the difference between decimal places and significant figures.

(c) The table shows the student's results.

Temperature in °C	Time taken for indicator in tubes with leaves to change from orange to red in minutes			
	1	2	3	mean
15	50	40	40	43
20	35	40	35	37
25	25	30	25	27
30	10	10	15	12
35	15	10	10	12

(i) Calculate the mean time taken for the indicator to change from orange to red at 25 °C.

Give your answer to two significant figures.

(2)

$\frac{25+30+25}{3} = 26.\dot{6}$

$= 27$ (2sf)

mean time = 27 minutes

ResultsPlus
Examiner Comments

This answer gained two marks for a correct final answer. The working is shown clearly.

ResultsPlus
Examiner Tip

Be clear about the difference between significant figures and decimal places.

(c) The table shows the student's results.

Temperature in °C	Time taken for indicator in tubes with leaves to change from orange to red in minutes			
	1	2	3	mean
15	50	40	40	43
20	35	40	35	37
25	25	30	25	
30	10	10	15	12
35	15	10	10	12

(i) Calculate the mean time taken for the indicator to change from orange to red at 25 °C.

Give your answer to two significant figures.

(2)

$\frac{25+25+30}{2} = 26.67$ minutes

mean time = 26.67 minutes

ResultsPlus
Examiner Comments

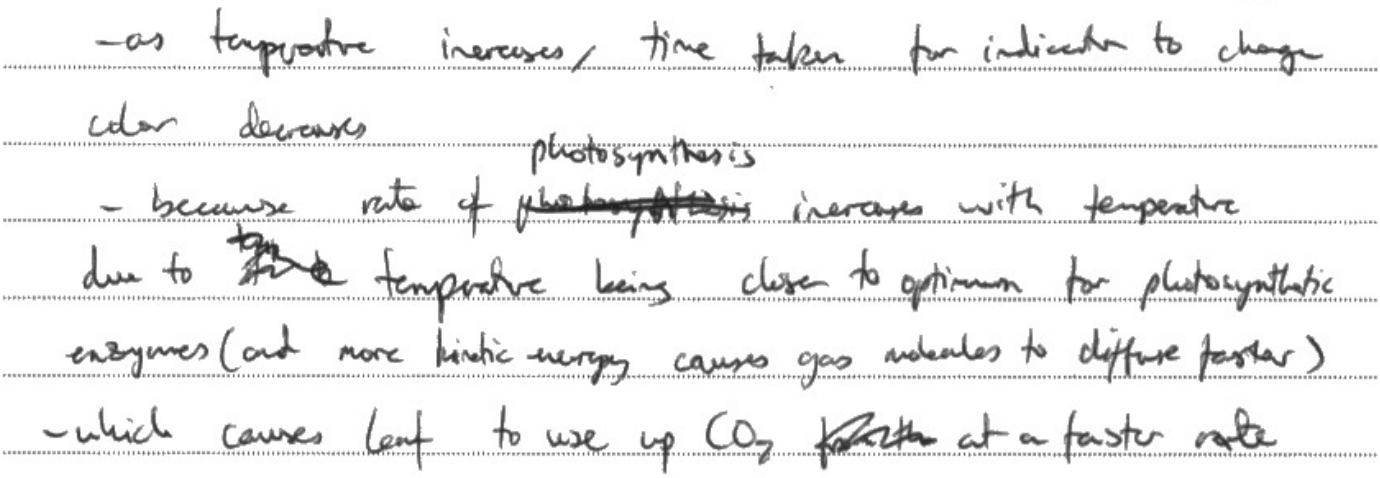
This answer gained one mark for the correct calculation of the mean but did not get a mark as the final answer is not given to two significant figures.

Question 4 (c)(ii)

This challenging question was well answered by many candidates and the examiners were impressed with how well candidates understood gaseous exchange in plants. Strong answers explained that increasing the temperature would increase the rate of photosynthesis due to more kinetic energy and this would lead to an increased uptake of carbon dioxide. Only a few candidates noticed that there was no effect of increasing temperature from 30 °C to 35 °C due to another factor limiting the rate of photosynthesis – candidates should explore all aspects of data in graphs and tables. A common error seen in weaker answers was a lack of explanation with only descriptions of the data given – candidates should be careful to focus their answers with regard to the command word.

(ii) Explain the effect of increasing the temperature on the mean time taken for the indicator to change from orange to red.

(3)



ResultsPlus
Examiner Comments

This is a very good answer that gains all three marks. There is a correct reference to an increase in rate of photosynthesis due to being close to the optimal temperature for enzymes and the answer then goes on to explain that the indicator changes colour due to faster removal of carbon dioxide.

(ii) Explain the effect of increasing the temperature on the mean time taken for the indicator to change from orange to red.

(3)

The mean time lowers because the indicator changes colour faster due to the it happening faster because the warmer the temperature is then the closer the enzymes are to working at their optimal temperature

ResultsPlus
Examiner Comments

This answer gained one mark for stating that the increased rate is due to the temperature being close to the optimum for the enzymes. No mention is made of photosynthesis or removal of carbon dioxide.

(ii) Explain the effect of increasing the temperature on the mean time taken for the indicator to change from orange to red.

(3)

~~As the time increases the t~~ As the temperature increases, the time taken decreases. Increasing the temperature increases the kinetic energy for a faster diffusion by gases. Photosynthesis can happen faster using more carbon dioxide and producing more oxygen to turn the solution red.

ResultsPlus
Examiner Comments

This is a good answer that explains that the rate of colour change increases due to faster photosynthesis, more kinetic energy and faster use of carbon dioxide.

(ii) Explain the effect of increasing the temperature on the mean time taken for the indicator to change from orange to red.

(3)

The time would increase and the change from orange to red would happen faster ~~and~~ in a shorter period of time.

ResultsPlus
Examiner Comments

This answer gained no marks. There is no explanation – only a description of a faster colour change is given.

Question 4 (d)

This question tested candidates' knowledge of how gas exchange in plants changes in the dark compared with the light. Many excellent answers were seen that explained that the indicator solution went yellow due to increased release of carbon dioxide due to the plant no longer photosynthesising but continuing to respire. A significant number of candidates incorrectly suggested that plants **start** to respire in the dark when photosynthesis stops.

(d) In another experiment, the student places a test tube containing a leaf and hydrogen-carbonate indicator in a 25 °C water bath.

The student then places all this apparatus in the dark for one hour.

Explain why the indicator solution changes from orange to yellow.

(2)

photosynthesis cannot take place without light, but plant still respires when respires releases CO_2, hydrogencarbonate indicator turns yellow in high concentration of CO_2

ResultsPlus
Examiner Comments

This excellent answer explains that photosynthesis will stop in the dark but respiration will continue leading to an increase in carbon dioxide release. The answer gained both marks.

ResultsPlus
Examiner Tip

Be clear that respiration in plants occurs in the light and dark and does not start in the dark.

(d) In another experiment, the student places a test tube containing a leaf and hydrogen-carbonate indicator in a 25 °C water bath.

The student then places all this apparatus in the dark for one hour.

Explain why the indicator solution changes from orange to yellow.

(2)

because when in the dark plants can photosynthesis and they only respire so the concentration of CO_2 will increase so it will turn from orange to yellow.

ResultsPlus
Examiner Comments

This is a good answer that gained two marks for stating that photosynthesis stops but respiration is continuing leading to an increase in carbon dioxide release.

Question 5 (a)(i)

This question asked candidates to name the gland that releases FSH. Most were able to name the pituitary gland although a number of candidates incorrectly referred to ovaries.

Question 5 (a)(iii)

This question asked candidates to explain the roles of FSH and LH in the female menstrual cycle. Most candidates were able to gain at least two marks with a significant number gaining all four. Strong answers stated that FSH leads to maturation of egg cells and the release of oestrogen, and LH stimulates ovulation and the release of progesterone. Some candidates confused the roles of FSH and LH with oestrogen and progesterone and some suggested that FSH stimulates ovulation.

(iii) Describe the roles of FSH and LH in the menstrual cycle.

(4)

FSH

- stimulates growth of follicle
- stimulates oestrogen production ~~release~~

LH

- stimulates progesterone release
- breaks down uterus lining

ResultsPlus
Examiner Comments

This answer gained three marks for correctly stating that FSH stimulates the growth of follicles, FSH stimulate oestrogen production and that LH stimulates progesterone release.

(iii) Describe the roles of FSH and LH in the menstrual cycle.

(4)

FSH

FSH ~~causes~~ (or FSH (follicle - stimulating hormone) causes an egg to mature in one of the ovaries, in a structure called a follicle. FSH also stimulates the release of ~~oe~~ oestrogen

LH

LH (luteinising hormone) stimulates the release of an egg from ~~the~~ an ovary at day 14 which is ~~also~~ ovulation.

ResultsPlus
Examiner Comments

This answer gained three marks for correctly stating FSH stimulates egg maturation, FSH stimulates the release of oestrogen and LH stimulates egg release (ovulation).

(iii) Describe the roles of FSH and LH in the menstrual cycle.

(4)

FSH

FSH stimulates the maturing of an egg in the follicle of an ovary (follicle stimulating hormone) FSH

LH

LH stimulates the release of the egg out the follicle into the fallopian tube from the ovary

ResultsPlus
Examiner Comments

This is a typical example of an answer that gained two marks for stating that FSH matures eggs and LH stimulates ovulation.

(iii) Describe the roles of FSH and LH in the menstrual cycle.

(4)

FSH

Stimulates egg development. Stimulates release of ~~progesterone~~ estrogen.

LH

Stimulates egg release. Stimulates release of progesterone.

ResultsPlus
Examiner Comments

This excellent answer gained four marks for correctly stating that FSH stimulates egg development, FSH stimulates oestrogen release, LH stimulates ovulation and LH stimulates progesterone release.

Question 5 (b)

This longer answer, discussion question focused on candidates' critical analysis of unfamiliar data presented to them. The information given to them was about three different methods of hormonal contraceptive and the question asked candidates to focus on the advantages and disadvantages of the method. Most candidate were able to gain at least three marks with many going on to gain all five. The examiners were impressed with the excellent standard of responses and it is clear that candidates and centres are preparing well for longer answer questions focused on unfamiliar data. Most candidates were able to state that the tablets had a slightly lower effectiveness and were able to explain the tablets are easy to use, do not require surgery, can be stopped quickly but can easily be forgotten. Most candidates were able to give an advantage and disadvantage of the implant and injection, typically focused on the long-lasting nature of the methods, the need for medical supervision, and the risk of infection or pain.

(b) Reproductive hormones can be used as contraceptives to prevent pregnancy.

The table gives information about three different methods of hormonal contraception.

Method	Description	Percentage effectiveness in preventing pregnancy (%)
oral tablets	• tablets taken every day at same time	91 to 99
injection	• injection into muscle by medical professional • injection is repeated every 12 weeks	94 to 99
implant	• plastic rod containing hormones is surgically placed under skin of upper arm • can last for up to three years and then needs replacing	94 to 99

Discuss the advantages and disadvantages of the three methods of contraception shown in the table.

(5)

oral tablets are good because it is the easiest way of intake because you will not feel pain by injection and a surgery and the percentage of effectiveness is high (91% to 99%). but the tablets have to be taken every day and a woman may forget to take it everyday and the percentage of effectiveness is the lowest percentage between the 3 methods.
injection is a good method because its percentage of effectiveness is higher than the percentage of effectiveness of oral tablets, and you will not have to take every day and every 12 weeks is enough time to relax your muscles and get healed from the pain. but injections may not be good because you will have to wait and find a good medical professional which will take time and will be more expensive than tablets and injection may be painful. implants are a good method because its percentage of effectiveness is higher than oral tablets and there is a long period of time between replacing implants (3 years). but it may not be good because surgeries are painful and expensive, its the most expensive method and some females may experience infections due to tissue rejection of the plastic rod.

(Total for Question 5 = 11 marks)

ResultsPlus
Examiner Comments

This excellent answer gained five marks. The effectiveness of the methods is compared and advantages and disadvantages are given for each method, for example, the answer explains that the tablets do not cause pain but are easy to forget. The answer is structured well so that it is easy to see mark points.

(b) Reproductive hormones can be used as contraceptives to prevent pregnancy.

The table gives information about three different methods of hormonal contraception.

Method	Description	Percentage effectiveness in preventing pregnancy (%)
oral tablets	• tablets taken every day at same time	91 to 99
injection	• injection into muscle by medical professional • injection is repeated every 12 weeks	94 to 99
implant	• plastic rod containing hormones is surgically placed under skin of upper arm • can last for up to three years and then needs replacing	94 to 99

Discuss the advantages and disadvantages of the three methods of contraception shown in the table.

(5)

For oral tablets:

Advantage: Doctor or medical professional is not required for a person to take the tablets. Minimum

Disadvantage: Percentage effectiveness is low. The person may forget to take the pill which will result in pregnancy.

For injection:

Advantage: Person does not need to take injection everyday. Percentage effectiveness is higher than oral tablets.

Disadvantage: Medical professional required. It can be painful for few people. Comparatively more cost than oral tablets.

For implant:

Advantage: Can work for a long time without replacement. Percentage effectiveness is high.

Disadvantage: Surgery required which may cause infection. More cost and can be painful.

ResultsPlus
Examiner Comments

This is another excellent answer that gains all five marks. The effectiveness of all three methods is compared and there is at least one clear advantage and disadvantage of each method. The answer is structured well so that it is easy to see marks.

(b) Reproductive hormones can be used as contraceptives to prevent pregnancy.

The table gives information about three different methods of hormonal contraception.

Method	Description	Percentage effectiveness in preventing pregnancy (%)
oral tablets	• tablets taken every day at same time	91 to 99
injection	• injection into muscle by medical professional • injection is repeated every 12 weeks	94 to 99
implant	• plastic rod containing hormones is surgically placed under skin of upper arm • can last for up to three years and then needs replacing	94 to 99

Discuss the advantages and disadvantages of the three methods of contraception shown in the table.

(5)

Advantages of oral tablets is that you can do it by yourself without any help and it may be cheaper than others. Disadvantages are you need to repeat the same process everyday and has less effectiveness to prevent pregnancy Advantages of injection are, it shows more effect to prevent pregnancy than oral tablets and you do not need to do it everyday. Disadvantages are you still need to do it every 12 weeks and it may affect bad for your muscles. Advantages of implant is it has better effect to prevent pregnancy than oral tablets and needs more time to replace it back. But it needs a surgery. **(Total for Question 5 = 11 marks)**

ResultsPlus
Examiner Comments

This example gained all five marks. An advantage and a disadvantage of oral tablets are given and a comparison of the effectiveness. An advantage and disadvantage of the injection are also given. Only a disadvantage is given for the implant (surgery idea) but the advantage is already given as a comparison of effectiveness.

(b) Reproductive hormones can be used as contraceptives to prevent pregnancy.

The table gives information about three different methods of hormonal contraception.

Method	Description	Percentage effectiveness in preventing pregnancy (%)
oral tablets	• tablets taken every day at same time	91 to 99
injection	• injection into muscle by medical professional • injection is repeated every 12 weeks	94 to 99
implant	• plastic rod containing hormones is surgically placed under skin of upper arm • can last for up to three years and then needs replacing	94 to 99

Discuss the advantages and disadvantages of the three methods of contraception shown in the table.

(5)

Advantages :-

Taking oral tablets do not have side effects

Disadvantages :-

Using implant method it ~~has to be repeated on~~ needs to be ~~repeated~~ replacing by doing surgical which might effect the skin.

ResultsPlus
Examiner Comments

This example only gains one mark. The comment about side effects is incorrect. One mark was given for the need for implant surgery being a disadvantage.

Question 6 (a)(i)

This question required candidates to give an account of the process of selective breeding. Although many candidates gained both marks for correctly describing the selection and cross pollination of parents with bright flowers and the selection and pollination of offspring with bright flowers, many candidates found the question challenging. A number of candidates incorrectly referred to taking cuttings or methods of asexual reproduction. A number of answers gained the first mark point for selecting and breeding the parents but then vaguely suggested 'repeating this many times' rather than describing the repeat over several generations. It is important to give answers that are precise and accurate.

6 The photograph shows a plant called a snapdragon.

(Source: © BRIAN GADSBY/SCIENCE PHOTO LIBRARY)

Selective breeding has been used to produce snapdragons with brightly coloured flowers.

(a) (i) Describe how selective breeding can produce snapdragon plants with brightly coloured flowers.

(2)

Snapdragon plants with brightly coloured flowers are selected and bred together. Repeat over several years to obtain all brightly-colour-flavored snapdragons.

ResultsPlus
Examiner Comments

This excellent answer gains both marks for stating that the parents with bright flowers are chosen and bred together and then goes on to say that this is repeated over generations.

6 The photograph shows a plant called a snapdragon.

(Source: © BRIAN GADSBY/SCIENCE PHOTO LIBRARY)

Selective breeding has been used to produce snapdragons with brightly coloured flowers.

(a) (i) Describe how selective breeding can produce snapdragon plants with brightly coloured flowers.

(2)

Choose snapdragon plants with ~~the~~ most brightly coloured flowers and breed them with one another to produce offspring with the same features. Repeat this over several generations.

ResultsPlus
Examiner Comments

This answer gained two marks for selecting the bright coloured parents and breading them and then repeating over several generations.

6 The photograph shows a plant called a snapdragon.

(Source: © BRIAN GADSBY/SCIENCE PHOTO LIBRARY)

Selective breeding has been used to produce snapdragons with brightly coloured flowers.

(a) (i) Describe how selective breeding can produce snapdragon plants with brightly coloured flowers.

(2)

~~choose~~ choose snapdragon with brightly coloured flowers - Use ~~micropro~~ micropropagation to breed over many generations.

ResultsPlus
Examiner Comments

This answer gained no marks. The answer correctly states that brightly coloured flowers are selected but does not state that they are crossed. The answer also incorrectly refers to micropropagation.

Question 6 (a)(ii)

This question required candidates to give an outline account of micropropagation. Many excellent answers were seen that gained all three marks. Common creditworthy responses included references to agar, sterile technique, the taking of small samples (explants alone was not credited as it was referred to in the question), the use of named nutrients such as glucose, and the use of plant growth factors. Candidates should be encouraged to give specific examples of nutrients rather than using the term 'nutrient' alone. Another common error was describing the taking of cuttings and putting them into soil rather than micropropagation.

(ii) Micropropagation is often used to make copies of a snapdragon plant.

Describe the process of micropropagation.

(3)

Explants are taken from a parent plant. They are trimmed to about 0.5 - 1 mm. Then ~~they~~ sterilised in bleach to kill microorganisms and introduced in agar medium which has plant hormones to encourage growth. Then to induce root formation, its transferred to another medium with different hormones, then transplanted in a foggy greenhouse.

ResultsPlus
Examiner Comments

This excellent answer gained three marks. There is a correct reference to small pieces of plant (0.5 mm) that are then sterilised. There are also correct references to agar and plant hormones.

ResultsPlus
Examiner Tip

Always give key details such as sterile agar and give named examples of nutrients.

(ii) Micropropagation is often used to make copies of a snapdragon plant.

Describe the process of micropropagation.

(3)

The plants are cut using scissor (Clcalpel) and ~~the shoot~~ the plant is called The explant. The explant Then is placed into sterile agar medium and it contains plant growth hormones. Then it is placed into the rooting powder to induce root formation and are grown in glasshouses where temperature, light intensity and humidity are controlled.

ResultsPlus
Examiner Comments

This excellent answer gained three marks. No credit was given to the description of explants as there was no reference to size. Marks are awarded for the references to sterile, agar medium and the use of plant hormones.

(ii) Micropropagation is often used to make copies of a snapdragon plant.

Describe the process of micropropagation.

(3)

An explant (a part of a plant cut from a shoot) is trimmed and placed in sterile agar culture where the shoots grow. Then the plant is placed in a culture solution in which the roots get the required conditions to grow properly. Afterwards, these plants are planted in compost or damp soil and placed in glasshouses (greenhouses) to show rapid and efficient growth.

ResultsPlus
Examiner Comments

This answer gained two marks for stating that the explant is placed into agar that is sterile. No credit was given for the term explant without a reference to the small size.

(ii) Micropropagation is often used to make copies of a snapdragon plant.

Describe the process of micropropagation.

(3)

A part of the plant containing the stem is cut off the plant. It is then placed in a solution of nutrients and agar medium. Then it is planted in the soil. Explants begin to grow.

ResultsPlus
Examiner Comments

This answer gained one mark for the reference to agar. Nutrients without mention of a named nutrient was not given credit.

Question 6 (b)(i)

This question asked for a reason why micropropagation was used to produce the tissue samples used in the experiment. The reason in this experiment was that it was important to have genetically identical cells at the start. Many candidates correctly stated that micropropagation would produce genetically identical clones, but a significant number gave other, generic reasons for using micropropagation such as producing many plants at any time of the year. It is important that the context of the question is considered when writing answers.

(b) Scientists investigate the effect of exposing snapdragon explants to increasing amounts of ionising radiation.

This is the scientists' method.

- take a snapdragon plant and use micropropagation to produce many explants
- expose groups of explants to different amounts of ionising radiation
- grow the explants into plants and record the number of differences in their phenotypes compared with the original plant
- take samples of each of the plants and measure the number of differences in DNA nucleotides of each plant compared with the original plant

(i) Give the reason why micropropagation is used to produce the plants to be tested.

(1)

because micropropagation produces genetically identical plants

ResultsPlus
Examiner Comments

This answer correctly describes the production of genetically identical cells so gained one mark.

(b) Scientists investigate the effect of exposing snapdragon explants to increasing amounts of ionising radiation.

This is the scientists' method.

- take a snapdragon plant and use micropropagation to produce many explants
- expose groups of explants to different amounts of ionising radiation
- grow the explants into plants and record the number of differences in their phenotypes compared with the original plant
- take samples of each of the plants and measure the number of differences in DNA nucleotides of each plant compared with the original plant

(i) Give the reason why micropropagation is used to produce the plants to be tested.

(1)

Because micropropagated plants are just clones.

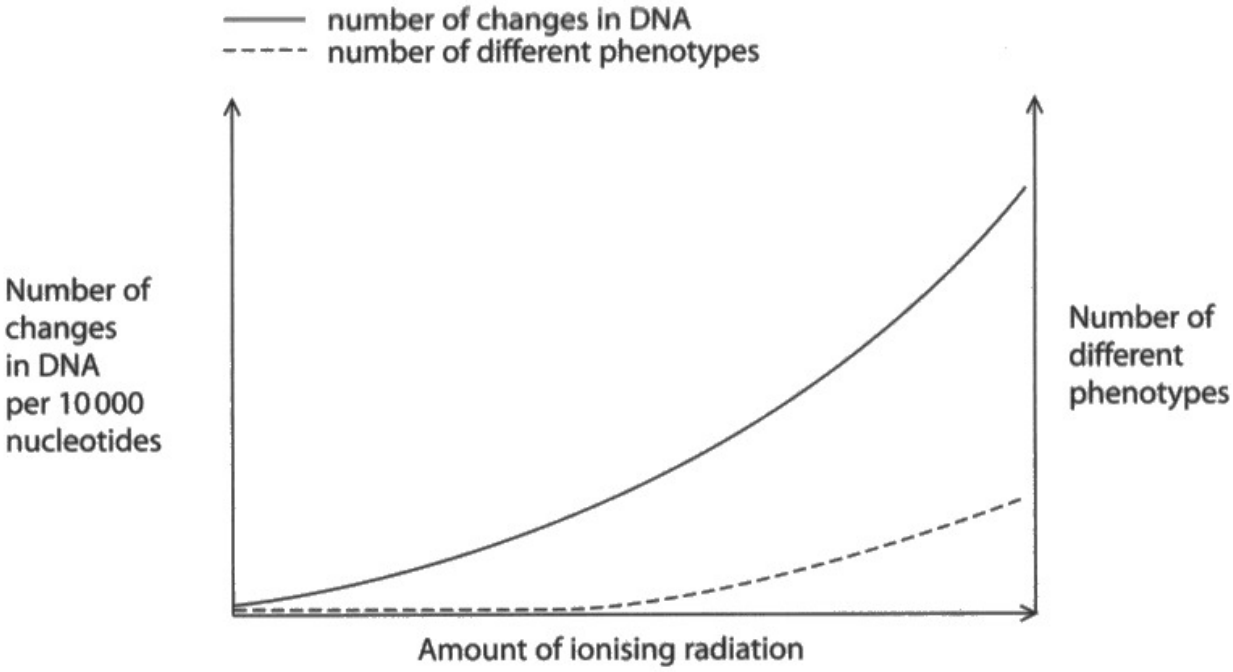
ResultsPlus
Examiner Comments

This answer gained the mark for stating that the plants will be clones.

Question 6 (b)(iii)

This challenging question was well answered by many candidates. The question tested candidates' knowledge of mutations and their effects. Strong answers explained that with increasing exposure to ionising radiation, the number of changes to DNA increased along with the number of phenotypes but the number of changes increased more. Some candidates referred to rate of changes – care should be taken with answers as the horizontal axis was not time. Stronger answers went on to explain that mutations can change the sequences in amino acids, thus affecting proteins and enzymes but in some cases, amino acids do not change so that proteins do not change and so have no effect on phenotype. Some answers also correctly stated that many mutations will be recessive and not observed. Some answers were of an exceptional quality and went far beyond the bounds of the specification. Weaker answer that tended to score one or two marks tended to be restricted to descriptions of the data.

(iii) The graph shows the scientists' results.



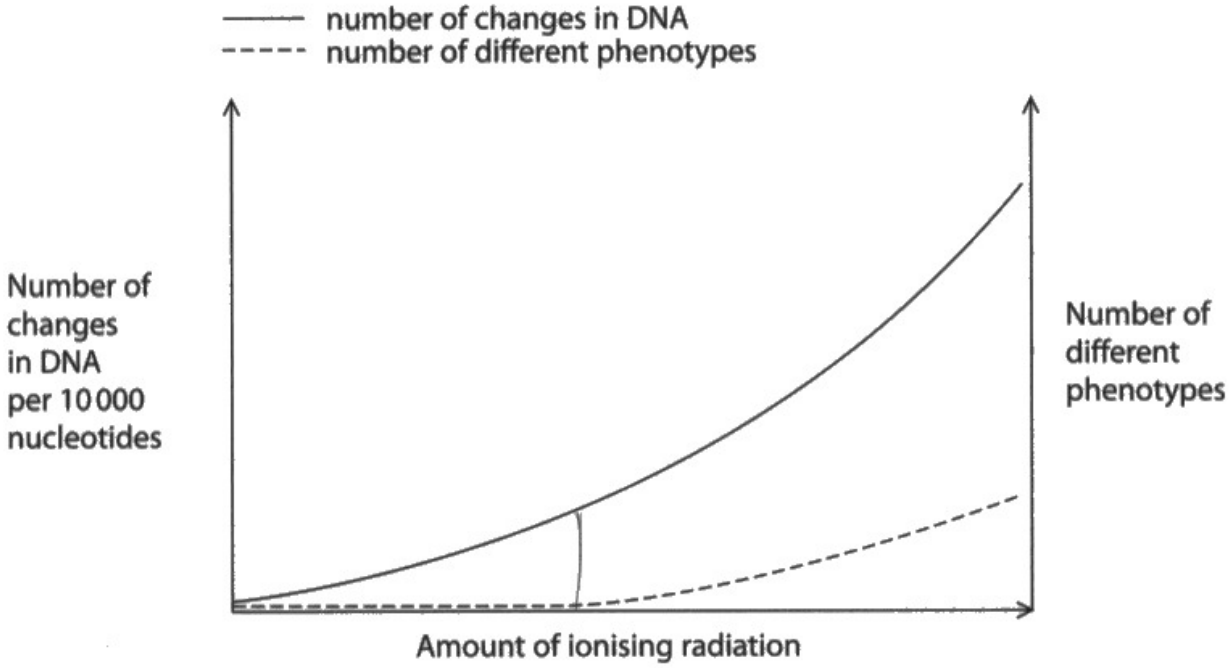
Discuss the effects that increasing the amount of ionising radiation has on the snapdragons.

(4)

Increasing amount of ionising radiation increases the number of changes in DNA and phenotypes, in the snapdragons. This is because ionising radiation causes mutations in the bases of the DNA. This can sometimes change the amino acid the codon codes for, causing a different protein to be made. This could change the genotype and as a result the phenotype of an organism and cause more variation, as we see in the graph. However, this might not always be the case which is why the number of DNA changes is much higher than the phenotype.

This excellent answer gained four marks. The increase in both phenotypes and DNA changes is stated and a correct reference made about mutations. The candidate goes on to correctly explain that amino acid sequences might change to produce different proteins, thus affecting the phenotype. They also state that the number of DNA changes increases more than phenotype changes.

(iii) The graph shows the scientists' results.



Discuss the effects that increasing the amount of ionising radiation has on the snapdragons.

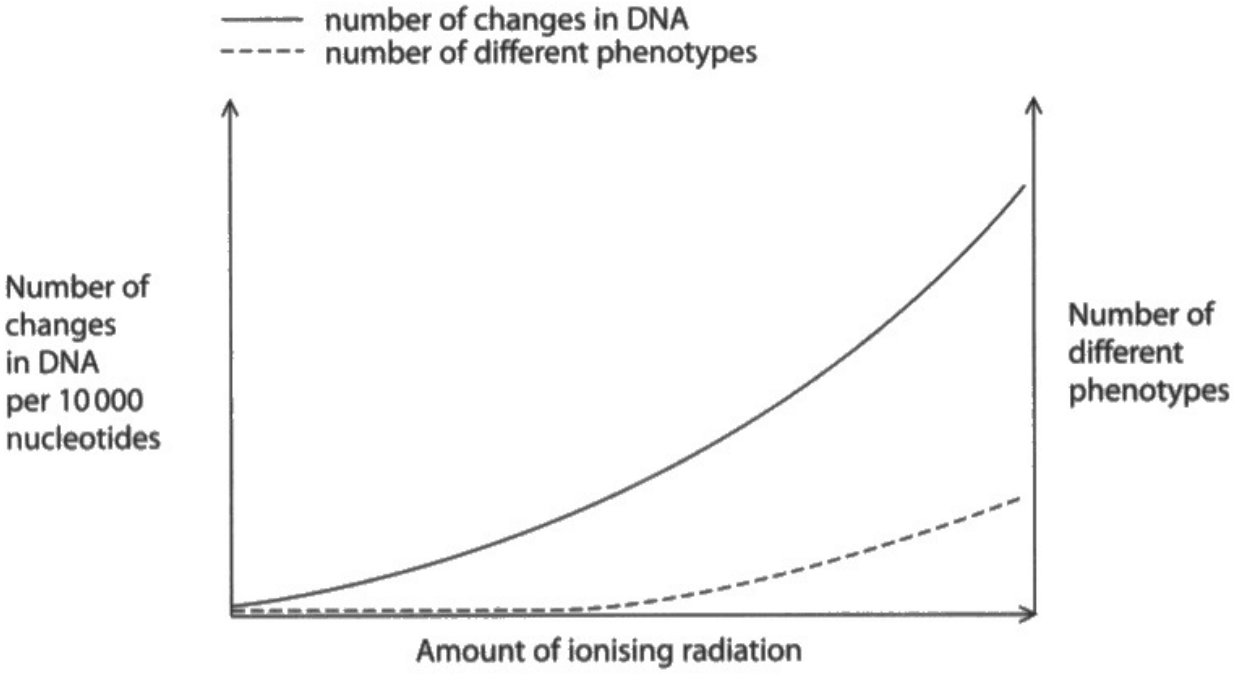
(4)

As the amount of ionising radiation increases so does the number of changes in the snapdragon DNA. This increase is non linear and occurs due to bases being changed by the ionising radiation. The number of different phenotypes also increases however it stays level until the number of changes has already increased. This may be due to some changes occuring in non coding regions, ~~having no effect~~ still coding for the same codon, or occuring in a recessive allele when the organism is heterozygous which would allow changes to occur without changes to the phenotype.

(Total for Question 6 = 11 marks)

This is another excellent answer that gains all four marks. The candidate has identified that both DNA changes and phenotypes increase and stated that the phenotypes increase less. There are also correct references to changes within non-coding regions of DNA and the fact that many changes are recessive.

(iii) The graph shows the scientists' results.



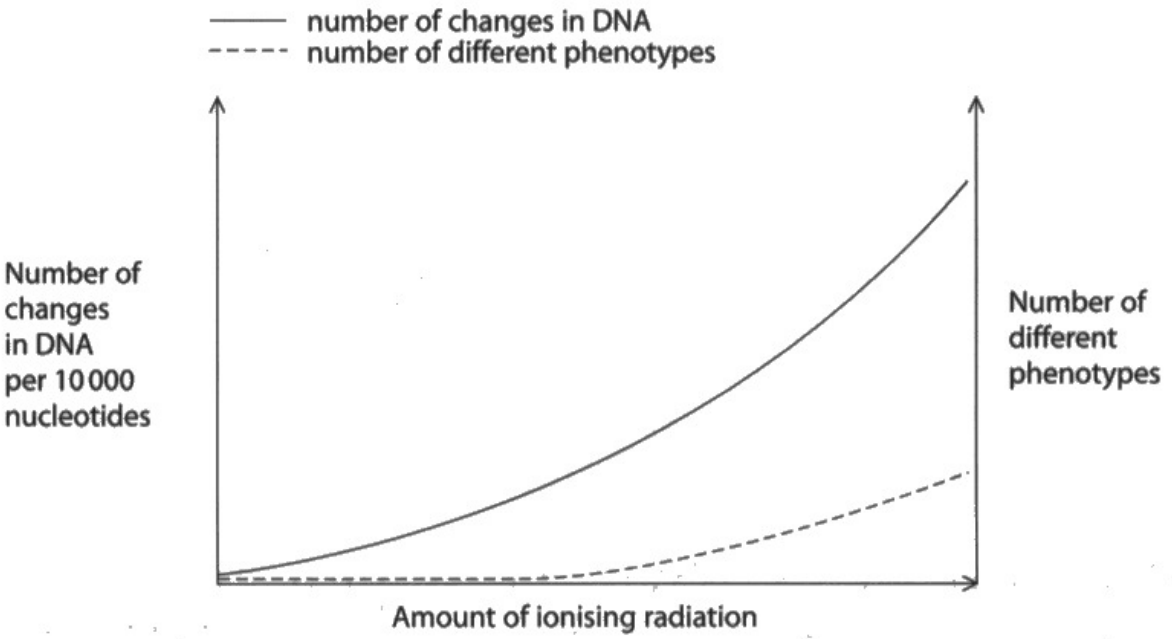
Discuss the effects that increasing the amount of ionising radiation has on the snapdragons.

(4)

- As amount of ionising radiation, increases, both number of different phenotypes and number of changes in DNA increase
- number of changes in DNA increases more than number of different phenotypes as ionising radiation causes mutation by changing the sequence of bases in amino acid changing the protein which can lead to a change in the phenotype.
- New allele might be recissive so change in phenotype does not occur as fast as change in DNA

This is an excellent answer that explains that both DNA changes and phenotype numbers increase. The changes are explained in terms of alterations to amino acid sequences and the fact that some changes do not cause a phenotypic change due to being recessive.

(iii) The graph shows the scientists' results.



Discuss the effects that increasing the amount of ionising radiation has on the snapdragons.

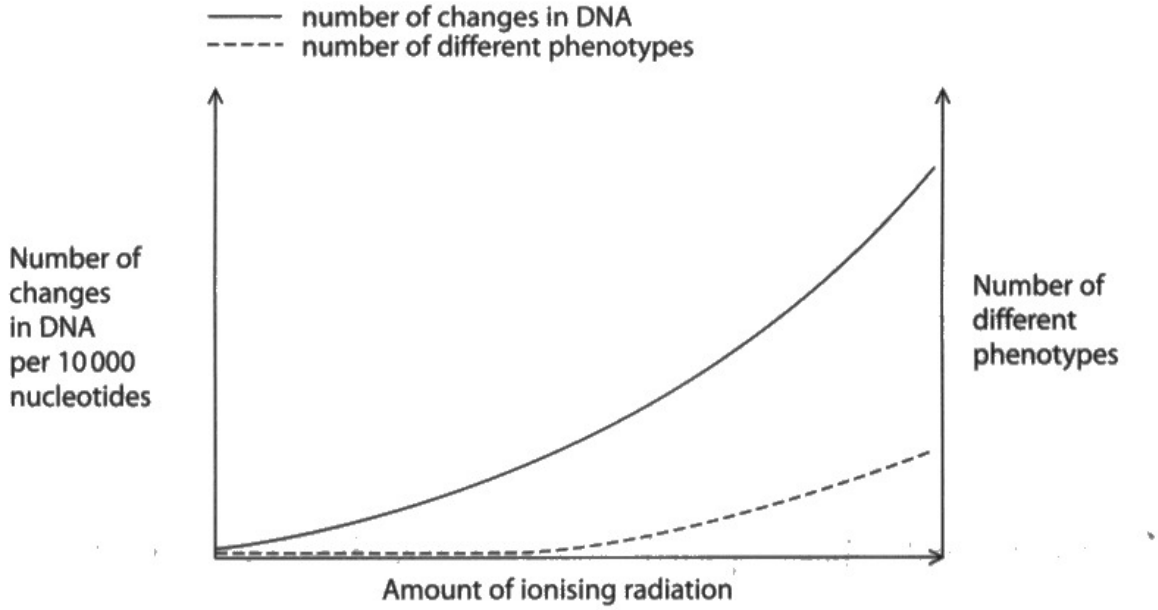
(4)

The increasing amount of ionising radiation cause an increase in number of changes in DNA per 10 000 nucleotides. As ionising radiation increases, number of different phenotypes also increases. Genetic variation in the snapdragons increases. But the ~~the~~ increase in number of different phenotypes is less than number of changes in DNA per 10 000 nucleotides.

ResultsPlus
Examiner Comments

This answer gained two marks for correct descriptions of increase in DNA changes and number of phenotypes. No possible explanations are given, but reference is made to there being more changes in the DNA than the number of phenotypes.

(iii) The graph shows the scientists' results.



Discuss the effects that increasing the amount of ionising radiation has on the snapdragons.

(4)

→ According to the graph, ↑ increase in ionising radiation increases the number of canges in DNA per 10 000 nucleotides. Also number of different phenotypes also increase with an increase in ionisation. This means, explants exposed to more ionisation would ~~should~~ show more varieties of pk features than those under less ionisation. ~~so~~ This may cause more good qualities to be expressed in the phenotype but sometimes diseases might also get expressed.

ResultsPlus
Examiner Comments

This answer gained just one mark for recognising that increased exposure to radiation increases the number of different phenotypes and the number of changes to the DNA.

Paper Summary

Based on their performance on this paper, candidates should:

- Be fully conversant with the demands of all the command words used in the specification.
- Use key, accurate terminology to support their answers.
- Analyse data with confidence, describing patterns, manipulating numerical data and drawing conclusions.
- Remember when asked to evaluate and discuss conclusions from data, to comment on how the data supports and opposes the conclusion and discuss the quality of the experiment.
- Show all working for calculations.

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