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Examiners' Report
June 2022

International GCSE Science (Single Award) 4SS0 1B

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Introduction

This is the second summer series in which this qualification has been offered. Examiners saw a range of responses to these questions from those showing outstanding knowledge and understanding of the specification content to those that showed little knowledge or understanding of the topics in the specification. Many candidates were able to apply their knowledge to novel scenarios and to use their skills to interpret experimental data.

There was no evidence of candidates being short of time and most candidates attempted all questions. Candidates did especially well on the experiment design question and the bar chart and its interpretation. This shows the work that candidates and their teachers have done to prepare for the examination.

Questions that proved more challenging included the explanation of how the structure of a leaf is adapted for photosynthesis and describing how bacteria can be genetically modified to produce large quantities of human insulin. Some candidates also struggled to correctly calculate percentage change.

Question 1 (b)

This question required candidates to give three differences between the structure of the bacterium shown in the diagram and the structure of a plant cell. Most candidates were able to score some marks, with the best responses giving three differences.

(b) Give three differences between the structure of this bacterium and the structure of a plant cell.

(3)

1 ~~The bacterium is lack of a vacuole~~ The bacterium contains plasmid while a plant cell does not

2 The bacterium is lack of mitochondria

3 ~~The cell wall of~~ The bacterium is lack of a nucleus

ResultsPlus
Examiner Comments

This response gains all three marks for three correct differences.

ResultsPlus
Examiner Tip

Candidates should make it clear which organism they are writing about. In this case it is the bacterium.

This response scores two marks for two correct differences.

(b) Give three differences between the structure of this bacterium and the structure of a plant cell.

(3)

1 Bacterium ~~has a~~ has planning.

2 Plant cell has cell wall.

3 Plant cell has mitochondrium

ResultsPlus
Examiner Comments

The second difference is incorrect as the bacterium also has a cell wall.

Question 2 (a)(ii)

The diagram in Q2 shows part of the human thorax with structures P, Q, R, S and T labelled. This question asked candidates to give three ways that structures labelled T are adapted for efficient gas exchange. Most candidates could gain some credit, with the best responses gaining all three marks.

(ii) Give three ways that structures labelled T are adapted for efficient gas exchange.

(3)

1 They have thin 1 cell thick walls to reduce the distance for diffusion and increase the rate of gas exchange.

2 They have a dense capillary network so rich blood is supplied so it difusion of gasses take place easily which increases the rate of gas exchange

3 There are many of these tiny structures so they have a higher surface area to volume ratio resulting in efficient gas exchange.

ResultsPlus
Examiner Comments

This response not only gives three ways that the alveoli are adapted for efficient gas exchange, it also explains how the adaptations increase the gas exchange.

ResultsPlus
Examiner Tip

If a question asks candidates to give three ways, it does not expect an explanation as to how the ways increase gas exchange.

(ii) Give three ways that structures labelled T are adapted for efficient gas exchange.

(3)

1 Structure T is the alveoli and have a high surface area to volume ratio to enable better diffusion to take place.

2 Alveoli have one cell thick walls to lower the distances gases have to travel to diffusing - making gas exchange efficient.

3 Alveoli are surrounded with a complex network of capillaries so that gas can be exchanged between the alveoli and blood in capillaries.

ResultsPlus
Examiner Comments

This response also scores three marks for three correct ways.

(ii) Give three ways that structures labelled T are adapted for efficient gas exchange.

(3)

1 They have large surface area for difusion

2 They have thin walls to provide short distance for ~~diffusion~~ diffusion.

3 They are moist to allow gasses to easily be absorbed

ResultsPlus
Examiner Comments

This response also scores three marks for three correct ways.

(ii) Give three ways that structures labelled T are adapted for efficient gas exchange.

(3)

1 One cell thick so the distance that gases must diffuse is lower.

2 Moist lining so gases can be dissolved.

3 Has larger surface area so more oxygen and carbon dioxide can be diffused.

ResultsPlus
Examiner Comments

This response also gains three marks for giving three correct ways.

Question 2 (b)(i)

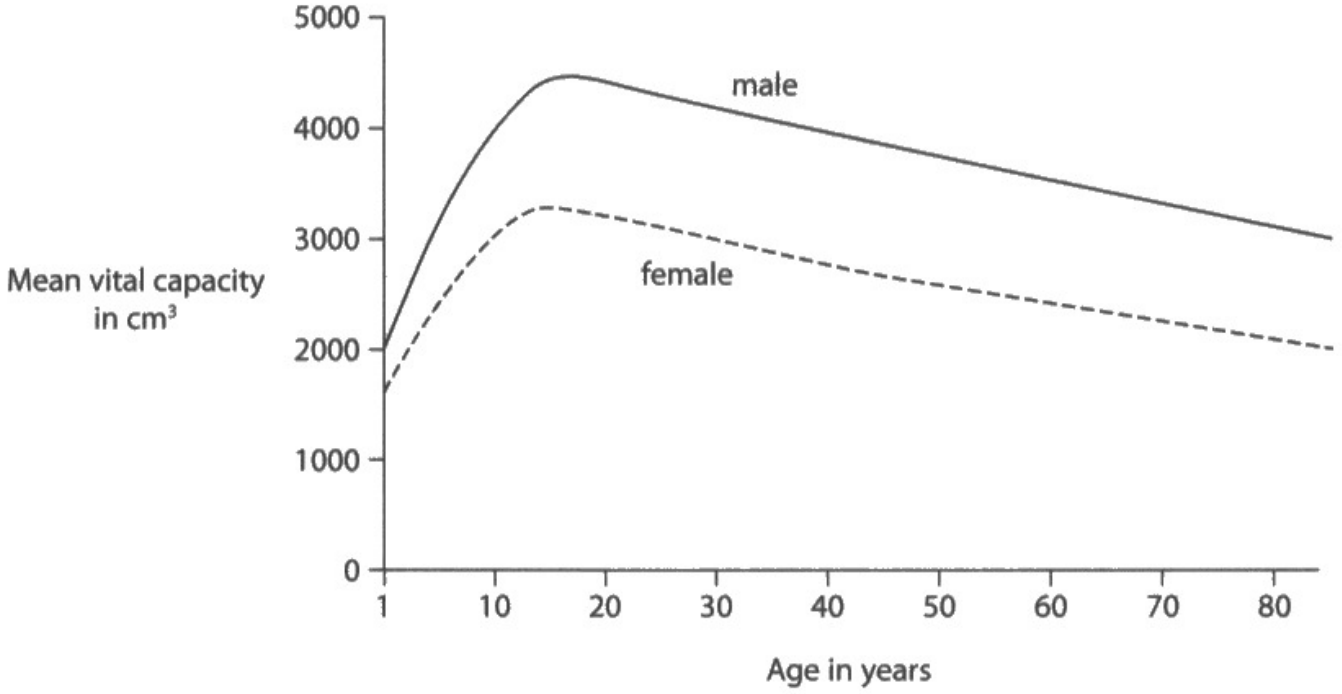
In Q2(b) candidates were told that vital capacity is a measure of how much air can be forced out of the lungs in one breath.

The graph shows how mean vital capacity changes with age for males and for females. The candidates were asked to describe the relationship between mean vital capacity and age for males and for females.

Marks were given for describing the increase in capacity up to age 13-20 and the decrease from this age. A mark was also given for describing that the male vital capacity was always higher than the female.

(b) Vital capacity is a measure of how much air can be forced out of the lungs in one breath.

The graph shows how mean vital capacity changes with age for males and for females.



(i) Describe the relationship between mean vital capacity and age for males and for females.

(3)

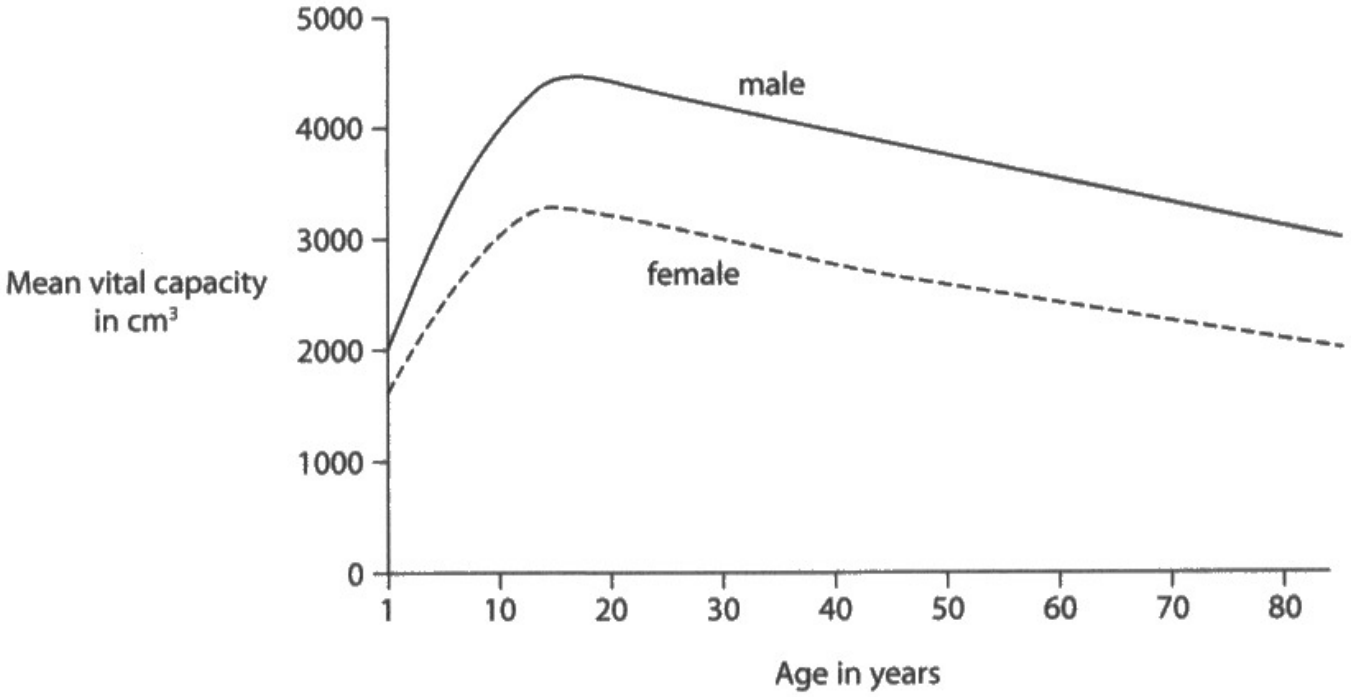
- Vital capacity of males always higher than ~~are~~ females.
- Both males & females vital capacity raise from (about 4600cm³ & 3200cm³) age 1 to age ~15 where it's reach it's top ✓
- After the age of 15, from there on the vital capacity of both genders decrease.

ResultsPlus
Examiner Comments

This response scores three marks for stating that male capacity is higher than female. It also correctly refers to the increase up to age 15 and decrease from age 15.

(b) Vital capacity is a measure of how much air can be forced out of the lungs in one breath.

The graph shows how mean vital capacity changes with age for males and for females.



(i) Describe the relationship between mean vital capacity and age for males and for females.

(3)

Overall, the mean vital capacity for males is higher than females. When it comes to males, it is seen that the mean vital capacity increases rapidly from ages 1 to around 15 (during adolescence), and then is seen to decrease ~~gradually~~ gradually during adulthood and old age. A similar pattern is seen for females, except that the decrease in capacity comes at a sooner age than for males and the overall capacity is less than males.

ResultsPlus
Examiner Comments

This response also scores three marks for the reference to male capacity being higher than female and a correct reference to capacity increasing to age 15, then decreasing.

ResultsPlus
Examiner Tip

When describing a graph, candidates should refer to data to support their description.

Question 2 (b)(ii)

Q2(b)(ii) asked candidates to suggest a reason for the difference between the mean vital capacity of males and of females. Most responses gained the mark for stating that males have bigger lungs or that they are taller or have a larger thorax.

(ii) Suggest a reason for the difference between the mean vital capacity of males and of females.

(1)

It may be because, that the lungs of males is bigger than Females, thus, more amount of air is forced out during the ~~the~~ Process.

ResultsPlus Examiner Comments

This response gains the mark for writing that the lungs of males are bigger than females.

(ii) Suggest a reason for the difference between the mean vital capacity of males and of females.

(1)

Men are usually bigger in the upper body as they have bigger torsos compared to woman meaning there is more space for the lungs to contract

ResultsPlus Examiner Comments

This response also gained the mark for writing that males have a bigger torso.

Question 3 (a)(i)

Question 3 gave a description of a variation of one of the core practical experiments listed on the specification. In this experiment, a student investigates the effect of the colour of light on the rate of photosynthesis in pondweed.

In Q3(a)(i) candidates were asked to calculate the percentage difference in the mean number of bubbles released when using green light compared to white light.

Only the strongest candidates were able to correctly calculate the percentage difference.

3 A student investigates the effect of the colour of light on the rate of photosynthesis in pondweed.

This is the student's method

- place a cut piece of pondweed in a beaker of water
- place a lamp, that produces white light, 10 cm from the beaker
- count the number of bubbles of oxygen released in one minute from the cut end of the pondweed
- repeat this count for two more one-minute periods

The student repeats the method using blue light, green light and red light.

The table shows the student's results.

Colour of light	Number of bubbles of oxygen released in one minute			
	Count 1	Count 2	Count 3	Mean (average)
white	16	15	17	16
blue	13	11	12	12
green	4	5	3	4
red	10	12	11	11

(a) (i) Calculate the percentage difference in the mean number of bubbles released when using green light compared to white light.

(2)

16-12=

12÷16=0.75

0.75x100=75

percentage difference = 75 %

ResultsPlus
Examiner Comments

This candidate correctly calculated the percentage difference.

3 A student investigates the effect of the colour of light on the rate of photosynthesis in pondweed.

This is the student's method

- place a cut piece of pondweed in a beaker of water
- place a lamp, that produces white light, 10 cm from the beaker
- count the number of bubbles of oxygen released in one minute from the cut end of the pondweed
- repeat this count for two more one-minute periods

The student repeats the method using blue light, green light and red light.

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white	16	15	17	16
blue	13	11	12	12
green	4	5	3	4
red	10	12	11	11

(a) (i) Calculate the percentage difference in the mean number of bubbles released when using green light compared to white light.

(2)

$\frac{4}{16} \times 100 = 400/16$

percentage difference = 25 %

ResultsPlus
Examiner Comments

This candidate gained one mark for dividing by 16, which was the comparator, but did not subtract the rate in green from the rate in white light.

ResultsPlus
Examiner Tip

Candidates should always show their working as they can often gain some credit even if the final answer is incorrect.

Question 3 (a)(ii)

Q3(a)(ii) asked candidates to give the independent variable in this investigation. Most were able to identify the colour of the light as the independent variable.

(ii) Give the independent variable in this investigation.

(1)

The Colour of the Light.

ResultsPlus
Examiner Comments

This correctly gives the independent variable.

(ii) Give the independent variable in this investigation.

(1)

Time taken, that is 1 minute, 10 cm from beaker.

ResultsPlus
Examiner Comments

This is not the independent variable.

ResultsPlus
Examiner Tip

Candidates need to be able to identify the independent variables in an investigation.

Question 3 (a)(iii)

In Q3(a)(iii) candidates were asked to give an abiotic variable that should be controlled in the investigation. Only the strongest candidates could correctly identify an abiotic variable such as temperature or light intensity.

(iii) Give an abiotic variable the student should control in their investigation.

(1)

The temperature of the water.

ResultsPlus
Examiner Comments

This is a correct abiotic variable that the candidate should control.

(iii) Give an abiotic variable the student should control in their investigation.

(1)

How close the light is from beaker

ResultsPlus
Examiner Comments

This was allowed as equivalent to the distance of the lamp from pondweed.

Question 3 (b)

Q3(b) asked candidates to comment on the effect of colour of light on the rate of photosynthesis. These longer response questions are a feature of the reformed international GCSE sciences and require candidates to synthesise a number of variables from data to form a judgement. The strongest candidates scored full marks while weaker responses earned some credit. The best responses linked the number of oxygen bubbles produced in white light to a higher rate of photosynthesis. They also noted that the rate was low in green light as chlorophyll reflects green light. They further commented on the absorption of red light and blue light by chloroplasts leading to more bubbles being produced in these colours.

(b) Comment on the effect of colour of light on the rate of photosynthesis.

(4)

when white colour light is used the rate of photosynthesis is high since more light can be absorbed. when using blue colour light the rate of photosynthesis is little lower than using white light since some light can be reflected. when using red light the rate of photosynthesis is lower as most of the light can be absorbed bo during photosynthesis.

however when using green light the rate of photosynthesis is very low since most of the light is reflected because the leaf is green aswell.

ResultsPlus
Examiner Comments

This response scores four marks. It comments that the rate is high in white light. It also notes that the rate in blue is lower than white. It comments that the rate in green light is very low as the light is reflected.

(b) Comment on the effect of colour of light on the rate of photosynthesis.

(4)

The Products of Photosynthesis is oxygen. This means that if more bubbles of oxygen is produced, the more photosynthesis is happening.

The colour with the most bubble produced is White with a mean number of bubble produced per minute of 16. This is followed by blue with 16 bubbles per minute (mean) And red produced 11 bubbles per minute (mean). lastly green with 4 bubble per minute (mean).

ResultsPlus
Examiner Comments

This response also scores four marks for commenting on the link between number of bubbles and rate of photosynthesis. It also notes that the colour with most bubbles is white, then blue and that green is last.

(b) Comment on the effect of colour of light on the rate of photosynthesis.

(4)

White light produces more oxygen bubbles (with a mean average of 16), oxygen is a product of photosynthesis. Therefore the experiment proves that white light by far results in the fastest photosynthesis rate.

The second best alternative is blue light (which produced a mean average of 12) chlorophyll has a better ability to absorb energy from white and blue lights. Resulting in a fast rate of photosynthesis. Red light comes a close second ~~th~~ to blue light with a mean average of 11. Chlorophyll can absorb a very limited amount of energy from green light as only 1 Oxygen bubbles were produced showing that ~~re~~ green light slows down the rate of photosynthesis.

ResultsPlus
Examiner Comments

This response also gains four marks. It makes the link between number of bubbles of oxygen and the rate of photosynthesis. It comments that white light produces the fastest rate. It notes that chlorophyll absorbs energy from blue light and a little energy from green light. It concludes that green light produces a slower rate of photosynthesis.

Question 3 (c)

Q3(c) asked candidates to explain how the structure of a leaf is adapted for photosynthesis. Only the best responses explained how each structural feature increases photosynthesis. The strongest candidates gained three or four marks. These responses explained that a leaf is wide and flat and has a large surface area for absorption of light and carbon dioxide. It is then so that no cell is far from the surface to absorb light. The upper epidermis is transparent so that light can pass through to the cell layers below. The palisade cells contain many chloroplasts to absorb light. The spongy mesophyll cells have many air spaces to allow gas exchange. The lower surface contains stomata that allow carbon dioxide to be absorbed. The leaf contains xylem vessels that bring water to the cells.

(c) Explain how the structure of a leaf is adapted for photosynthesis.

(4)

The upper epidemis of the leaf has a thin transperent layer which allows light to enter in, and there are many vertically aligned palisade cells that contain chloroplasts that absorbs that light for photosynthesis. Spongy mesophyll cells have air spaces that have a high surface area to volume ratio where gases like carbon dioxide can diffuse. Guard cells can open and close stomata so oxygen can diffuse out and carbon dioxide to diffuse in for photosynthesis

ResultsPlus
Examiner Comments

This response gains four marks. It explains how the transparent upper epidermis lets light pass through. It explains that the palisade cells contain chloroplasts to absorb light. It explains that the spongy mesophyll cells have air spaces for diffusion. It also explains that the stomata enables carbon dioxide to diffuse in.

ResultsPlus
Examiner Tip

Explain how each layer helps in photosynthesis.

(c) Explain how the structure of a leaf is adapted for photosynthesis.

(4)

The cuticle is a waxy coating layer that prevents water loss. The upper epidermis cells are transparent so because of this light energy can be easily pass through this layer to be absorbed by the next layer, palisade mesophyll cells. Palisade mesophyll cells are packed with chlorophyll ~~chloroplasts~~ which contain chloroplasts, this absorbs light in order for photo-synthesis to be carried out. Spongy mesophyll cells have many air spaces between them to increase the ~~gas~~ volume ~~exchange~~ gases in the leaf and to make sure gas exchange happens more efficiently. ~~and~~ Lower epidermis cells contain stomata, these are there for oxygen to leave the leaf and Carbon dioxide to enter the leaf. Gaurd cells are there to close the stomata when not used to prevent water loss.

(Total for Question 3 = 12 marks)

ResultsPlus
Examiner Comments

This response also gains four marks for explaining how the transparent upper epidermis allows light to reach the palisade layer which is packed with chloroplasts to absorb light. It also explains the air spaces in the spongy mesophyll to enable gas exchange. It finally explains the role of the stomata in allowing carbon dioxide to enter the leaf.

(c) Explain how the structure of a leaf is adapted for photosynthesis.

(4)

Firstly, the ~~structure~~ ~~of~~ leaf is surrounded by a layer of waxy cuticle. This is to prevent ~~water loss~~ entry of pathogens and to prevent water loss from evaporation, this helps photosynthesis. ~~the~~ The palisade mesophyll layer has hundreds of chloroplasts, this allows for a very efficient absorption of light, making it the main site for photosynthesis in the ~~leaf~~ leaf. The spongy ~~mesophyll~~ mesophyll layer has lots of air spaces, which assists the exchange of gases in the ~~leaf~~ leaf, it absorbs ~~carbon~~ carbon dioxide for photosynthesis and gets rid of the excess oxygen produced by diffusing it towards the guard cells. The guard cells are extremely specialised cells which control the opening and closing of the stomata, this means that it lets carbon dioxide in for photosynthesis, and lets oxygen diffuse out.

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Examiner Comments

This response gains three marks. It explains the role of the palisade cells, the spongy mesophyll and the stomata.

Question 4 (a)

This question asked candidates to name the process that releases energy in plant cells. The strongest candidates identified the process as respiration.

Question 4 (b)(i)

This question required candidates to describe a method that a scientist could use to determine the mean net primary productivity of temperate grassland in a year. This proved difficult for many candidates. Whilst most could score some marks for description of using a quadrat to sample in several random areas of the ecosystem, few candidates understood the idea of cutting the crop and measuring the new growth after one year.

(b) The productivity of plants in different ecosystems can be compared by calculating their net primary productivity.

Net primary productivity is the difference between the biomass produced and the biomass used.

The table shows the net primary productivity of different ecosystems in one year. This is measured in grams of biomass produced by one square metre of ground.

Ecosystem	Mean net primary productivity in one year in g per m^2
desert	80
temperate grassland	600
cultivated farmland	625
temperate deciduous forest	1250
tropical rainforest	2200

A temperate ecosystem has no extremes of temperature.

(i) Describe a method that a scientist could use to determine the mean net primary productivity of temperate grassland in a year.

(3)

The scientist could choose a specific place in the ~~each~~ ecosystem and use a quadrat to count each plant in that area. They are able to do this for several times and then find the average value over the months and get a mean value at the end of the year. This can be used to determine the mean net primary productivity of temperate grassland in a year.

ResultsPlus
Examiner Comments

This response scores two marks for reference to using a quadrat to sample and then repeating.

(b) The productivity of plants in different ecosystems can be compared by calculating their net primary productivity.

Net primary productivity is the difference between the biomass produced and the biomass used.

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tropical rainforest	2200

A temperate ecosystem has no extremes of temperature.

(i) Describe a method that a scientist could use to determine the mean net primary productivity of temperate grassland in a year.

(3)

Scientists can use quadrats to be placed in random area in the temperate grassland and can collect data at the start and after a year the Scientists can calculate the net primary productivity again in the quadrat.

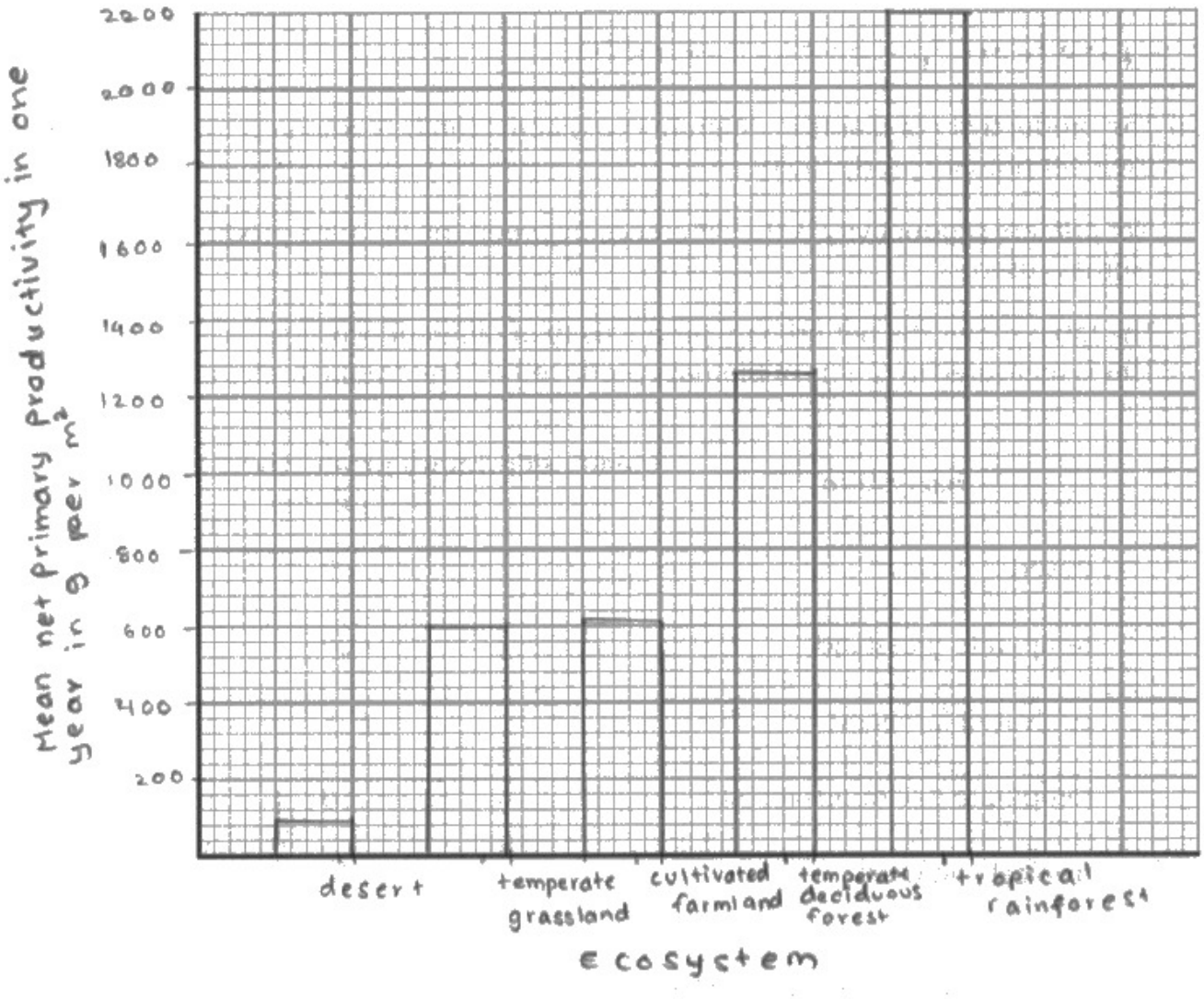
This response scores three marks. It mentions quadrats being used to take random samples.

Question 4 (b)(ii)

In this question candidates were required to draw a bar chart to show the mean net primary productivity in g per m^2 for each ecosystem in one year. Most candidates gained marks with many gaining full credit. Those who did not get full credit usually failed to use a linear scale or did not include the correct units.

(ii) Draw a bar chart to show the mean net primary productivity in g per m^2 for each ecosystem in one year.

(5)

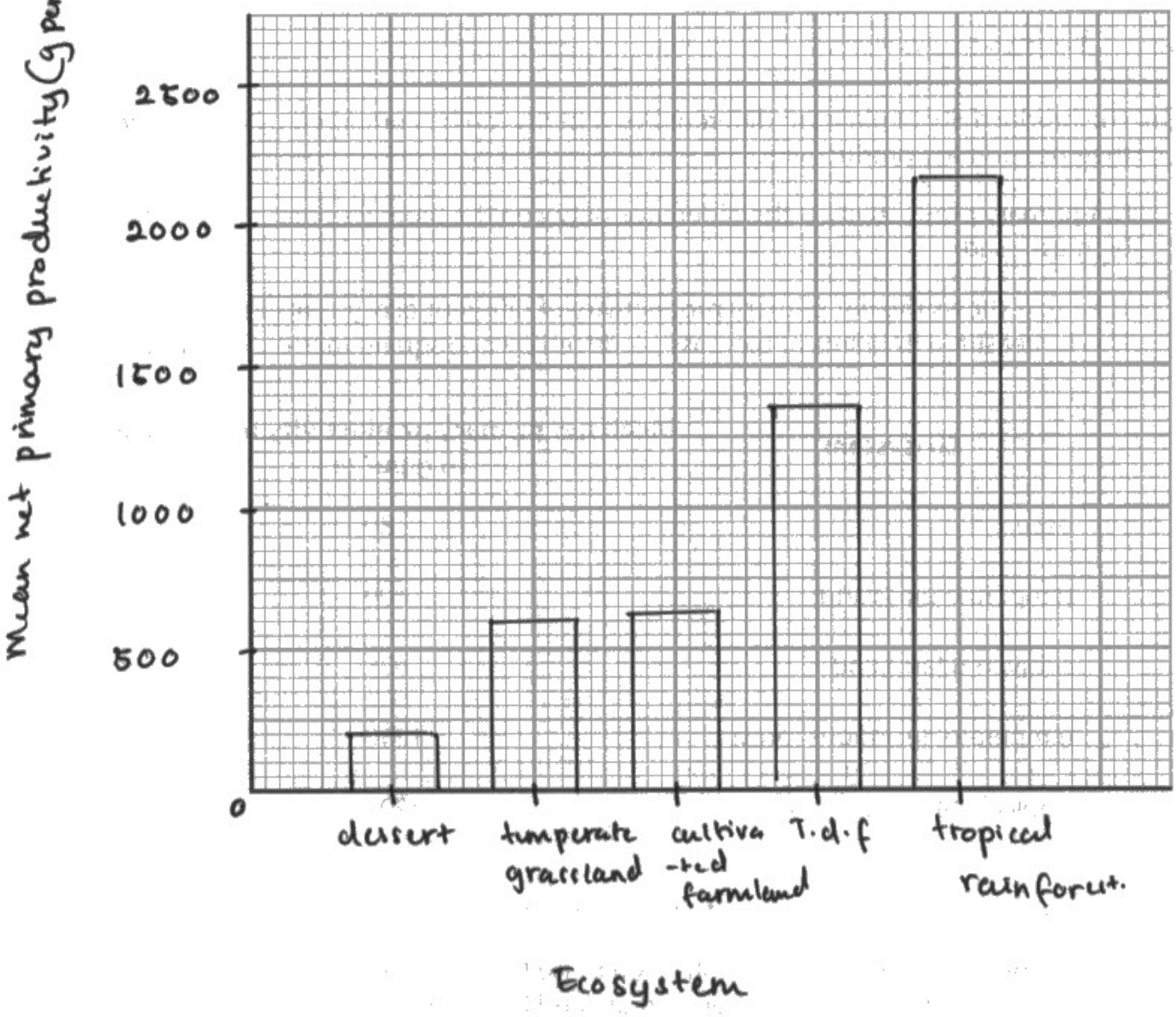


ResultsPlus
Examiner Comments

This bar chart scores five marks.

(ii) Draw a bar chart to show the mean net primary productivity in g per m^2 for each ecosystem in one year.

(5)

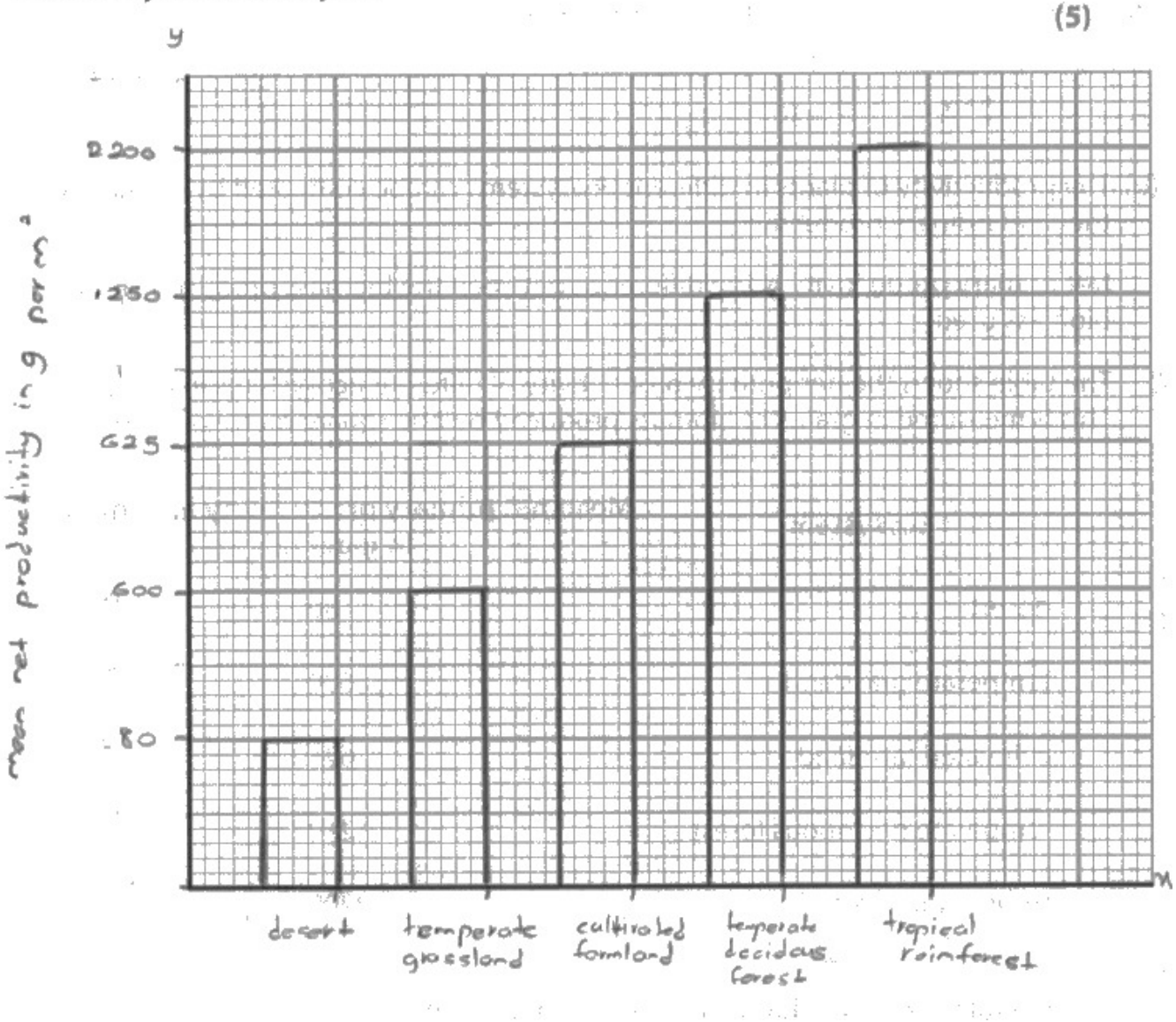


ResultsPlus
Examiner Comments

This bar chart scores four marks as the productivity of the desert ecosystem is incorrectly plotted.

(ii) Draw a bar chart to show the mean net primary productivity in g per m^2 for each ecosystem in one year.

(5)



ResultsPlus
Examiner Comments

This bar chart scores three marks as it does not have a linear scale, so the bars are not plotted correctly.

Question 4 (b)(iii)

In this question candidates were asked to comment on the differences between the mean net primary productivity in the ecosystems. The strongest candidates were able to link the productivity to their knowledge and understanding of the ecosystems.

(iii) Comment on the differences between the mean net primary productivity in the ecosystems.

(5)

- The biggest net productivity is in the tropical rainforest system. This is because it is humid in there and not dry. There is water present and the temperature is comfortable for the organisms.
- The smallest net productivity is in the dessert ecosystem. This is because the weather conditiones and temperature is extreme. So the energy is wasted there.
- temperate grassland and cultivated farmland ecosystems have a similar net productivity as both of them do not have extreme temperatures.
- A temperate deciduous forest has a high net productivity as just like in a rainforest it has good weather / temperature conditions. So the productivity is higher there than the ones in the other ecosystems except from the tropical rainforest.

(Total for Question 4 = 14 marks)

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Examiner Comments

This response comments on the tropical rainforest having the highest productivity due to availability of water and suitable temperature. It also comments that the desert has a low productivity because it has extreme temperatures. It notes that the temperate grassland and cultivated farmland have similar productivity and that the temperate, deciduous forest also has a high productivity.

(iii) Comment on the differences between the mean net primary productivity in the ecosystems.

(5)

In the dessert it has the least amount of mean primary productivity, this can be due to less water and minerals and ~~less~~ ~~reclimited~~ resources.. The tropical rainforest has the highest amount of mean productivity in the year this is because the rainforest has rich soil with minerals, vitamins and water. The mean net primary productivity of temperate grassland and the mean net primary productivity of cultivated farmland is close. The productivity of cultivated farmland ~~than~~ ~~might~~ is highe. than temperate grassland because in cultivated farmland they use fertilisers, etc..

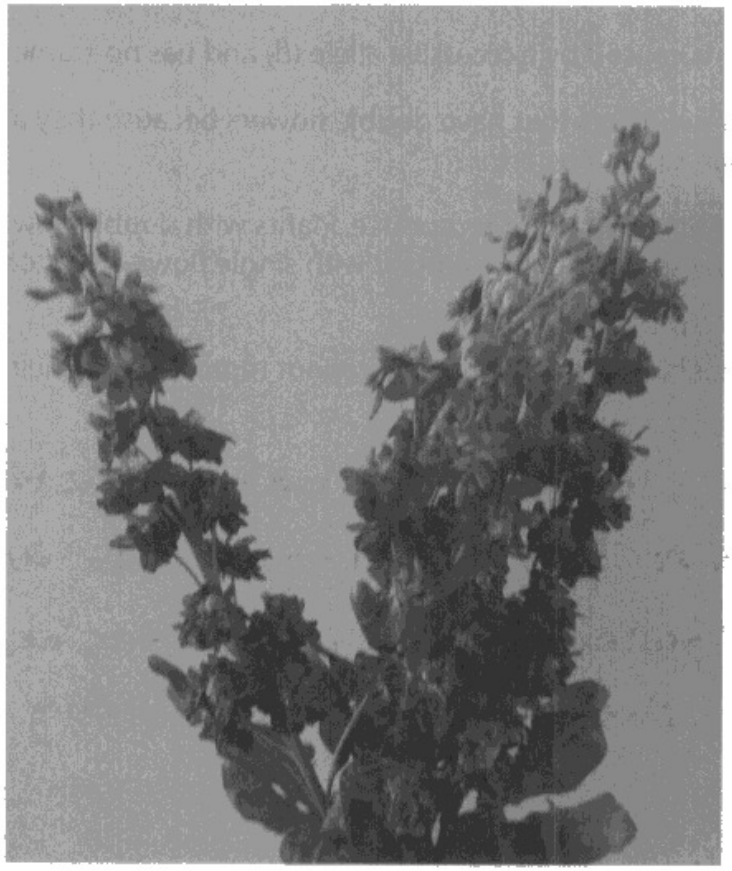
ResultsPlus
Examiner Comments

This response also scores full marks. It mentions that the desert has a low productivity due to lack of water. It notes that the tropical rainforest has the highest productivity with water available. It also comments on the higher productivity of cultivated farmland compared with temperate grassland due to the provision of fertilisers.

Question 5 (a)

This question required candidates to give two features of insect-pollinated flowers. Most candidates scored at least one mark with many scoring two. Common answers included large, coloured petals, scented flowers and nectar production.

5 The photograph shows an insect-pollinated plant called a stock.



(a) Give two features of insect-pollinated flowers.

(2)

1 Brightly - colored petals to attract insects.

2 Nectaries which scent attract insects.

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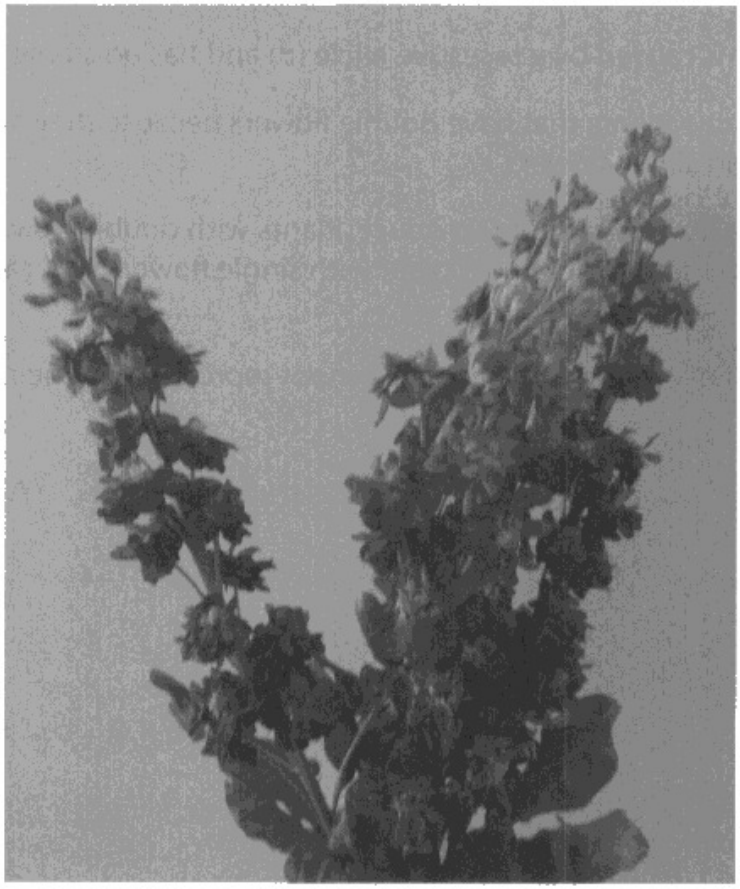
Examiner Comments

This scores both marks for reference to brightly coloured petals and to nectaries.

5 The photograph shows an insect-pollinated plant called a stock.



(a) Give two features of insect-pollinated flowers.

(2)

1 They have bright colour petals to attract insects

2 They have sweet nectar

ResultsPlus
Examiner Comments

This also scores two marks for bright coloured petals and sweet nectar.

Question 5 (b)(i)

Q5(b)(i) asked candidates to explain why plants with double flowers cannot reproduce on their own. Only the best responses earned both marks for explaining that without stamens the flowers could not produce pollen to fertilise the ovule.

(b) There are two types of stock plant. One type has single flowers and the other type has double flowers.

The double flower is caused by a recessive allele (d) and has no stamens.

Gardeners often grow plants that have double flowers because they are larger and last longer than single flowers.

Plants with double flowers cannot reproduce. Plants with double flowers are usually produced by self-pollinating a plant with single flowers that carries the recessive allele.

(i) Explain why plants with double flowers cannot reproduce on their own.

(2)

If double flowers have no stamen, this means that they do not have an anther which produces pollen grains, which are needed to fertilize the ovules in the ovary for reproduct-ion.

ResultsPlus
Examiner Comments

This scores full marks for no stamens to produce pollen for fertilisation.

(b) There are two types of stock plant. One type has single flowers and the other type has double flowers.

The double flower is caused by a recessive allele (d) and has no stamens.

Gardeners often grow plants that have double flowers because they are larger and last longer than single flowers.

Plants with double flowers cannot reproduce. Plants with double flowers are usually produced by self-pollinating a plant with single flowers that carries the recessive allele.

(i) Explain why plants with double flowers cannot reproduce on their own.

(2)

Because they don't have istamens. Because ~~istament~~ istamens is male reproductive part of flower, if there is no istamens then pollen grains will not Be produced.

ResultsPlus
Examiner Comments

This also scores two marks for no stamens so no pollen produced.

Question 5 (b)(ii-iii)

Q5(b)(ii) and Q5(b)(iii) gave candidates information that a plant with single flowers that carries the recessive allele is self-pollinated.

They were asked to draw a genetic diagram to show the parent genotypes, the gametes produced and the genotypes and phenotypes of the offspring. The candidates who had practiced these types of questions gained full marks. Some responses gained some credit but missed out the gametes or did not give the phenotypes of the offspring. In part (iii) candidates needed to calculate the expected number of plants with double flowers that will grow from 600 seeds.

(ii) A plant with single flowers that carries the recessive allele is self-pollinated.

Draw a genetic diagram to show the parent genotypes, the gametes produced, and the genotypes and phenotypes of the offspring.

(4)

f = double flower
F = single flower

X	F	f
F	FF	Ff
f	Ff	ff

FF = single
Ff = single
Ff = single
ff = double

(iii) This self-pollinated plant with single flowers produces 600 seeds.

Calculate the expected number of plants with double flowers that will grow from these seeds.

(2)

chance of double = $\frac{1}{4}$ or 25%

600 × 0.25 = 150

expected number = 150

ResultsPlus
Examiner Comments

This response scores full marks. It correctly uses a Punnett square to show the prenatal genotypes, gametes and genotypes and phenotypes of the offspring. It also correctly calculates the expected number of plants with double flowers.

(ii) A plant with single flowers that carries the recessive allele is self-pollinated.

Draw a genetic diagram to show the parent genotypes, the gametes produced, and the genotypes and phenotypes of the offspring.

(4)

Parent genotypes → Dd × Dd

Gametes → (D) (d) : (D) (d)

Punnet square →

	D	d
D	DD	Dd
d	Dd	dd

Offspring genotype (F1) → DD : Dd : Dd : dd

Offspring phenotype (F1) → single flower : single flower : single flower : double flower

(iii) This self-pollinated plant with single flowers produces 600 seeds.

Calculate the expected number of plants with double flowers that will grow from these seeds.

(2)

$\frac{1}{4} \times 100 = 25\%$

~~600 × 25 = 150,000~~

$600 \times \frac{1}{4} = 150$

expected number = 150

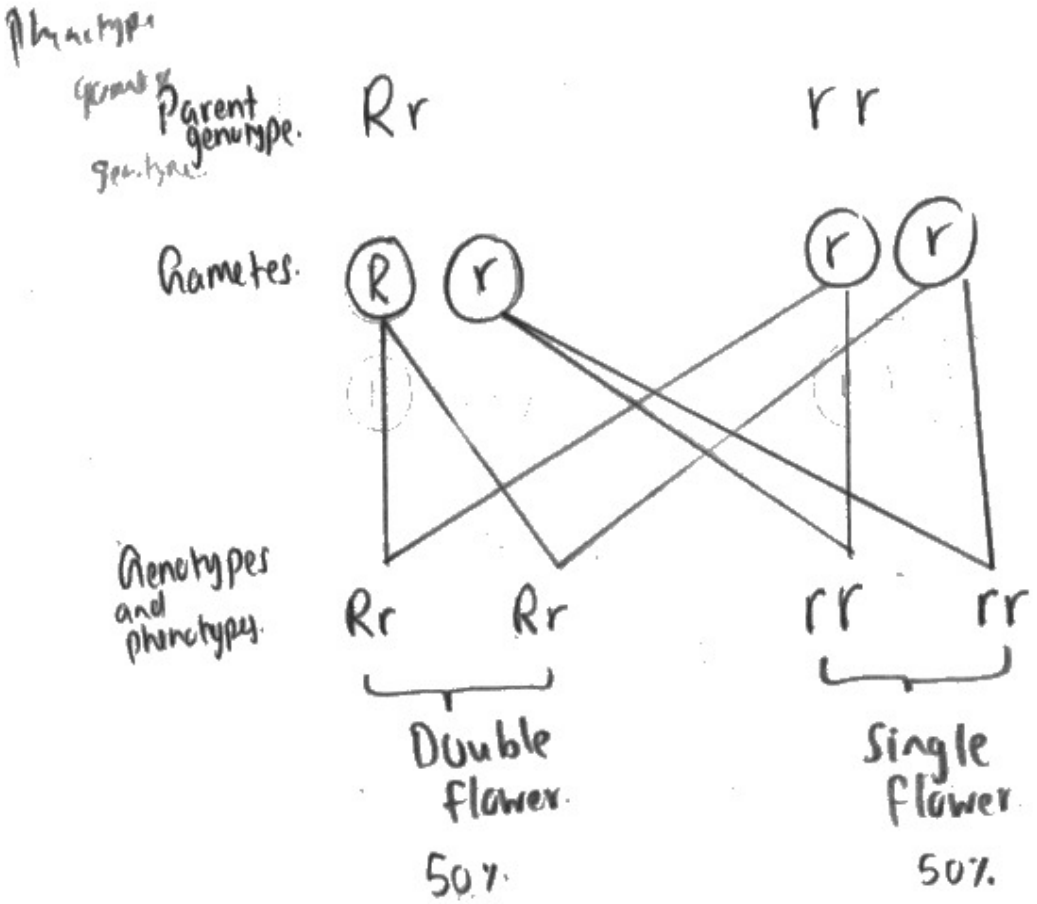
ResultsPlus
Examiner Comments

This response also scores full marks for parental genotypes, gametes and offspring genotypes and phenotypes. It correctly calculates the number of double flowered plants in part (iii).

(ii) A plant with single flowers that carries the recessive allele is self-pollinated.

Draw a genetic diagram to show the parent genotypes, the gametes produced, and the genotypes and phenotypes of the offspring.

(4)



(iii) This self-pollinated plant with single flowers produces 600 seeds.

Calculate the expected number of plants with double flowers that will grow from these seeds.

(2)

$\frac{50}{100} \times 600 = 300$

expected number = 300.

ResultsPlus
Examiner Comments

This response scores two marks for part (ii) and two marks for part (iii).

In part (ii) it has the wrong parental genotypes. However, it gains two marks since it correctly writes the gametes and offspring for their incorrect parental genotypes.

In part (iii) it also scores two marks for calculating the expected number of double flowered plants that would grow from their predicted genotypes.

Question 6 (a)

In Q6(a) candidates were asked to state what is meant by the term genetically modified bacteria. Only the strongest candidates could correctly state what is meant by this. Some vague responses such as a man-made bacterium gained no credit nor did writing that it was a bacterium with modified genes.

6 Genetically modified bacteria can be used to produce large quantities of human insulin.

(a) State what is meant by the term **genetically modified bacteria**.

(1)

Bacteria that ~~has~~ has been Modified through genetics

ResultsPlus
Examiner Comments

This response gained no credit.

ResultsPlus
Examiner Tip

Candidates need to be able to state what is meant by terms used in the specification.

6 Genetically modified bacteria can be used to produce large quantities of human insulin.

(a) State what is meant by the term **genetically modified bacteria**.

(1)

Genetically ~~mad~~ modifies bacteria are bacteria that have one of their genes removed and its replaced by ~~the gene that the mad~~ a ~~modified gene of~~ gene from another living organism.

ResultsPlus
Examiner Comments

This response gained the mark for the removal and replacement of the genes in the bacteria with a gene from another organism.

Question 6 (b)

In Q6(b) candidates had to describe how bacteria can be genetically modified to produce large quantities of human insulin. This topic comes straight from the specification content and those candidates who had prepared correctly for the examination had little difficulty in gaining full credit.

(b) Describe how bacteria can be genetically modified to produce large quantities of human insulin.

(4)

Human insulin DNA can be cut using ~~restriction~~ restriction ~~ed~~ endonucleas to form cut out DNA is then the plasmid which is the receptor (bacteria) can be * cut with same restriction endonucleas and ligase enzyme can be applied and sticky ends could be used to combine DNA and plasmid forming recombinant plasmid, that is how genitically modified bacteria can be made by using human insulin, they can reproduce to increase quantity and can be used as vector.

ResultsPlus
Examiner Comments

This response describes how restriction enzymes are used to cut human DNA and cut the plasmid to produce sticky ends which are then combined using ligase enzymes to join the DNA to the plasmid.

Question 7

Question 7 was the experimental design question that features on these papers. In this case candidates were required to design an investigation to find out which exercise programme (running or weights) is more effective at reducing resting heart rate. The strongest candidates who were familiar with these types of questions scored full marks. Almost all candidates scored at least two marks on this question. Some responses were written with just the prompts C, O, R, M and S but with no explanation as to what is meant by C or O etc. Such responses were unlikely to gain much credit.

7 Exercise programmes can reduce a person's resting heart rate.

Some programmes rely on long distance running while others rely on training with weights.

Design an investigation to find out which exercise programme is more effective at reducing resting heart rate.

Include experimental details in your answer and write in full sentences.

(6)

In the experiment 4 ~~to~~ people are used, two females and two males of the same age. (25) One pair of male and female (non-athletes) will rely of long distance running for ~~6 months~~ 1 month. Their resting heart rate will be measured at the start of the experiment and will be measured of the end of each month. The other couple will rely on training with weights, the same weights for ~~6 months~~ 1 month. Their resting heart rate will measured such as couple 1. ~~After the 6 months the couple will switch~~ Couple 1 will run in the same track each month. Both couple will train 4 time each week and find ~~and~~ an average every week, for one hour.

ResultsPlus
Examiner Comments

This response scores full credit. It includes the idea of repeating and controlling for the sex of the participant. It has some participants doing running and some weights for the same duration. It measures the heart rate at the start of the programme and then after a month.

7 Exercise programmes can reduce a person's resting heart rate.

Some programmes rely on long distance running while others rely on training with weights.

Design an investigation to find out which exercise programme is more effective at reducing resting heart rate.

Include experimental details in your answer and write in full sentences.

(6)

Get a number of people together, assign hals to long distance running and the other hals to weight training.

Before they start measure their resting heart rate over an hour to get an average to work from.

Assign them to do their task every day for 3 weeks.

At the end, measure everyones resting heart rate and compare it to the original results from before the experiment.

ResultsPlus
Examiner Comments

This response scores four marks. It gains credit for using the two programmes, measuring heart rate at the start and at the end of the programme. It also controls for the duration of the programme.

ResultsPlus
Examiner Tip

The response would be better if the candidate had used 10 people rather than a number. They could have then gotten a mark for repeating.

Paper Summary

Based on their performance on this paper, candidates should:

- ensure that you read the question carefully and include sufficient points to gain full credit.
- on 'comment' questions, include as many points as there are marks available and reach a conclusion that reflects the points you have made.
- ensure that you understand and are able to explain what is meant by the terms used in the specification.
- make sure you have practised calculations such as percentages.
- write in detail and use correct and precise biological terminology.
- remember to use the knowledge and skills acquired during practical work to help in questions about unfamiliar or novel practical procedures.
- on experimental design questions you should always be able to name the independent variable, give the range of values, the dependent and how you are going to measure it and the control variables and explain how these will be controlled.
- read through your responses and ensure that what you have written makes sense and answers the question fully.

Grade boundaries

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

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