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Examiners' Report
June 2022

International GCSE Biology 4BI1 1BR

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June 2022

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Introduction

The examiners were very impressed with the very high standard of many of the scripts. Candidates and centres should be commended for their hard work in preparing thoroughly for the examination, especially when many have experienced disruption to their education over the last two years. Many candidates had clearly scrutinised the Advance Information carefully with answers to topics that were listed often accurate and detailed. Maths and practical skills were generally very strong with many candidates scoring at least four marks for the experimental planning exercise. Graph skills were similarly very good with many scoring at least three marks. Some candidates found analysis of unfamiliar data challenging and the practising of data analysis should be a focus for future series. A few candidates lacked confidence with the use of detailed scientific vocabulary – candidates should always try to ensure that they add full depth and detail to their answers. Answers to longer, four and five mark questions were often excellent and it is clear that centres and candidates have got to grips with this style of question. Some candidates confused the requirements of the different command words, in particular 'describe', 'explain', 'evaluate' and 'discuss'. Candidates should be careful to practise questions with different command words when preparing for the exams. Most candidates were able to complete the paper in the allotted time and few left any questions blank.

Question 1 (b)

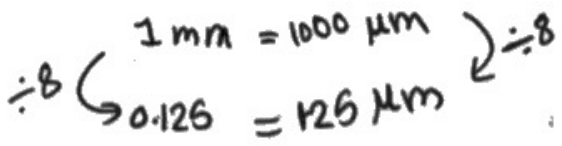
This question required candidates to measure the width of a cell and then go on to calculate the magnification. Candidates were also required to convert units. Most candidates were able to correctly gain two marks and many went on to gain all three. The main error seen was converting units incorrectly. Most candidates set out their working well methodically – this is good practice as it means that marks can still be gained even if the final answer is incorrect.

(b) The actual width of the cell from P to Q is 125 µm.

Determine the magnification of the diagram.

[1 mm = 1000 µm]

(3)



magnification = 0.125 mm

ResultsPlus
Examiner Comments

This answer gained one mark. The candidate has converted the units correctly but has not actually calculated the magnification.

(b) The actual width of the cell from P to Q is 125 µm.

Determine the magnification of the diagram.

[1 mm = 1000 µm]

(3)

$5 \times 10,000 = 50,000$

$\frac{50,000}{125} = 400$

magnification = 400

ResultsPlus
Examiner Comments

This answer gains all three marks. The candidate has correctly calculated the magnification. The working is clearly shown.

ResultsPlus
Examiner Tip

Always show all your working. Even if the final answer is incorrect, some marks may be awarded for correct methods.

Question 2 (a)(ii)

Over half of candidates were correctly able to state why viruses are not classed as living organisms. Many correctly stated that viruses do not satisfy all the criteria for the characteristics of life, or correctly gave one characteristic that they do not have (often independent reproduction or growth). Some candidates incorrectly stated that viruses do not contain a nucleus or organelles, confusing viruses with bacteria.

(ii) Give a reason why viruses are not considered to be living organisms.

(1)

Viruses do not carry out the basic life processes and they ~~are~~ just carry genetic information inside a protein coating.

ResultsPlus
Examiner Comments

This answer gained one mark for the idea that viruses do not carry out the life processes.

(ii) Give a reason why viruses are not considered to be living organisms.

(1)

They do not ~~do the~~ 8 characterists of life carry out the

ResultsPlus
Examiner Comments

This answer gained one mark for the idea that viruses do not possess all the 8 characteristics of life.

(ii) Give a reason why viruses are not considered to be living organisms.

(1)

because they need a host (living organism) to survive. They cannot survive by itself

ResultsPlus
Examiner Comments

This answer did not gain a mark as the requirement for a host could be a parasite.

Question 2 (b)

Many candidates correctly stated DNA ligase and restriction enzymes and went on to give their correct functions. Where candidates did not gain credit, it was frequently for either stating 'the enzymes with no functions' or for giving vague functions with no named enzymes. The question asked candidates for named enzymes – candidates should always be careful to read questions thoroughly to determine what is required in their answers. A few candidates gave incorrect enzymes such as proteases and/or implied that ligase joins proteins to DNA.

(b) A species of yeast is genetically modified to produce a protein found on the outside of a hepatitis B virus.

This protein is used to make vaccines to prevent people being infected with hepatitis B.

The gene for this protein is inserted into a plasmid.

This plasmid is then used to modify the yeast cells.

Give the roles of two named enzymes used to produce plasmids containing the gene for the hepatitis B protein.

(2)

Restrition enzyme is used to 'cuts' to DNA while the ligase is used it 'stick' it ~~make~~ back together.

ResultsPlus
Examiner Comments

This answer gained both marks. Both enzymes are listed and linked to their correct functions.

(b) A species of yeast is genetically modified to produce a protein found on the outside of a hepatitis B virus.

This protein is used to make vaccines to prevent people being infected with hepatitis B.

The gene for this protein is inserted into a plasmid.

This plasmid is then used to modify the yeast cells.

Give the roles of two named enzymes used to produce plasmids containing the gene for the hepatitis B protein.

(2)

ligase enzyme which sticks the DNa together (like glue) and DNA scissors

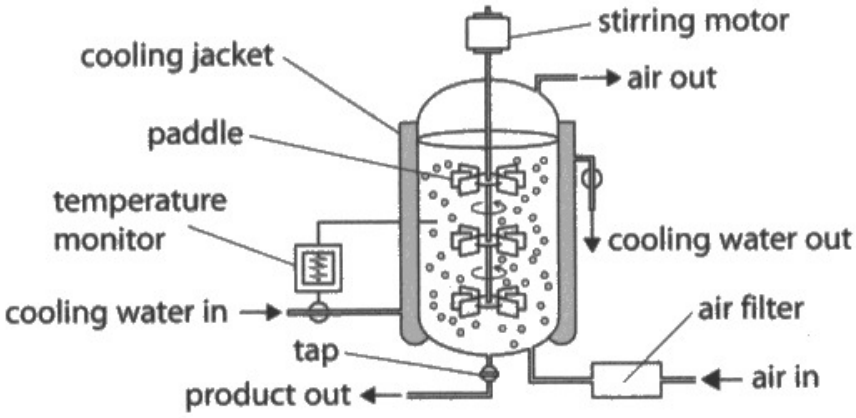
ResultsPlus
Examiner Comments

This answer gained one mark. The name and function of only one enzyme is given.

Question 2 (c)(i)

This question discriminated well. Many excellent answers were seen that explained that the sensor detects a rise in temperature which triggers the release of cold water to cool the fermenter. These stronger answers often went on to explain that the cooling water reduces the temperature to prevent enzymes denaturing. Fewer candidates explained that the respiration of the yeast would release heat energy. Some candidates incorrectly stated that the yeast denatures or that enzymes die. Candidates should be careful to use technical language accurately.

(c) The diagram shows an industrial fermenter that can be used to grow large quantities of genetically modified yeast.



(i) Explain the function of the temperature monitor and cooling jacket.

(3)

The cooling jacket helps maintain the temperature of the fermenter so that it will not overheat. The temperature monitor is used to track the temperature and makes sure that the fermenter is running at an optimum temperature, too high temperature will cause denaturing. This will help avoid it.

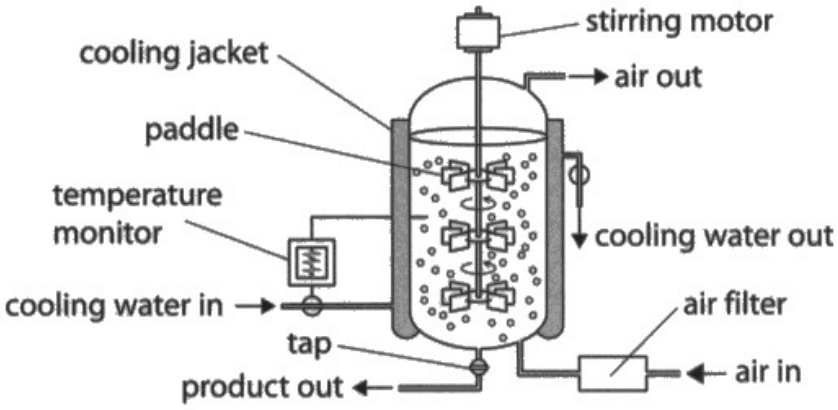
ResultsPlus
Examiner Comments

This answer gained two marks. The candidate correctly states that the cooling water prevents overheating and that this leads to an optimum temperature within the fermenter.

ResultsPlus
Examiner Tip

Always use technical terms such as denaturation and optimum temperature accurately.

(c) The diagram shows an industrial fermenter that can be used to grow large quantities of genetically modified yeast.



(i) Explain the function of the temperature monitor and cooling jacket.

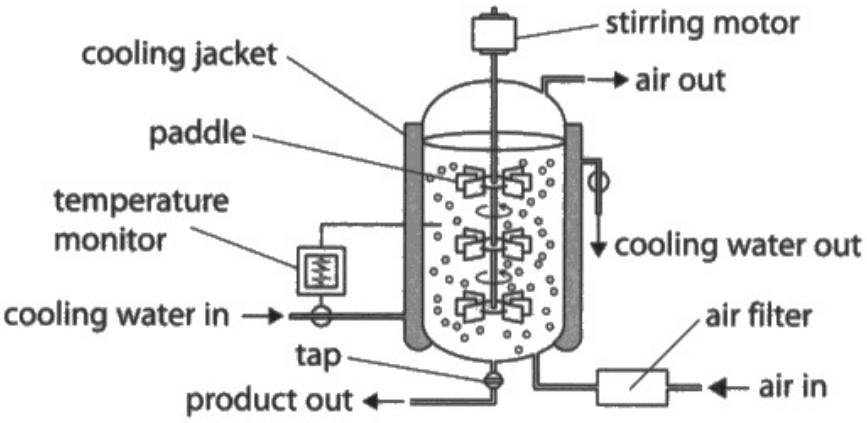
(3)

Enzymes work at an optimum temperature. This is because at high temperatures they will denature and the active site will deform. The temperature monitor measures the fermenter's temperature to ensure it does not get too hot for the enzymes. The cooling jacket maintains the internal temperature and can be used to reduce the temperature if the fermenter gets too hot

ResultsPlus
Examiner Comments

This excellent answer gained three marks. The candidate states that an optimum temperature is maintained and that the cooling prevents overheating and so prevents enzymes denaturing.

(c) The diagram shows an industrial fermenter that can be used to grow large quantities of genetically modified yeast.



(i) Explain the function of the temperature monitor and cooling jacket.

(3)

The fermentation process produces lots of heat and can cause contents to heat up. Cooling jacket prevents overheating to keep optimum conditions for the mixture. Temperature monitor used to monitor the temp and pump water in the jacket if temp is increasing or pump out if it is too low.

ResultsPlus
Examiner Comments

This strong answer gains all three marks. The candidate states that the fermentation releases heat and that the cooling jacket prevents overheating and maintains an optimal temperature.

Question 2 (c)(ii)

Most candidates were able to gain at least one mark. Most recognised that the air provided oxygen and many went on to explain that this is for respiration. A few candidates correctly stated that respiration occurs but they did not state that oxygen is needed from the air. A few candidates confused anaerobic respiration with aerobic respiration.

(ii) Explain why air is needed in the fermenter.

(2)

For respiration to produce energy to produce product

ResultsPlus
Examiner Comments

This answer gained one mark. The candidate clearly states that respiration occurs but does not refer to oxygen.

(ii) Explain why air is needed in the fermenter.

(2)

to oxygenate the water

ResultsPlus
Examiner Comments

This answer gained one mark for the idea of air providing oxygen but has not gone on to explain the role of oxygen in respiration.

(ii) Explain why air is needed in the fermenter.

(2)

the bacteria that are used to increase the yield of contents using the industrial fermenter require oxygen to respire to continue growing large quantities of yeast.

ResultsPlus
Examiner Comments

This answer is a very good answer that gains both marks.

Question 2 (c)(iii)

This question required candidates to recognise that the air entering the fermenter needs to be filtered to prevent the entry of microbes that would cause contamination or compete with the yeast for nutrients. Most gained at least one mark. Some candidates gave vague answers that referred to the filter preventing dirt or harmful substances entering the fermenter.

(iii) Explain why the air is filtered before going into the fermenter.

(2)

To prevent anything else in the air from entering the fermenter. ~~If~~ Some dirty molecules in air could damage the growing yeast.

ResultsPlus
Examiner Comments

This answer did not gain any marks. The candidate has vaguely stated that the filter prevents other substances entering the fermenter but has not referred to microorganisms.

ResultsPlus
Examiner Tip

Always give specific details in answers. In this question, a reference to preventing the entry of microorganisms is needed.

(iii) Explain why the air is filtered before going into the fermenter.

(2)

To ~~a~~ They filter air so no bacteria or ~~air~~ unwanted micro-organisms can enter the yeast fermenter, preventing contamination. This also prevents competition for sugars and oxygen.

ResultsPlus
Examiner Comments

This answer gained two marks. The candidate has clearly stated that filter prevents the entry of microorganisms which would compete for nutrients.

Question 3 (a)(ii)

Many candidates found this question challenging. Strong answers that gained credit recognised that an ecosystem comprises all the organisms along with the environment. A significant number of candidates gave vague descriptions of some organisms in an area or suggested that an ecosystem consisted of the animals in an area. When asked to give definitions, candidates should be careful to give accurate and precise definitions.

(ii) State what is meant by the term **ecosystem**.

(1)

The interaction between organisms and their environment ~~to live~~. in order to sustain itself.
The interaction between biotic and abiotic factors in an ~~area~~ environment to sustain itself

ResultsPlus
Examiner Comments

This candidate gained a mark for correctly stating that an ecosystem consists of the biotic and abiotic factors in an area.

(ii) State what is meant by the term **ecosystem**.

(1)

A measure of all the different species and communities living together in a habitat.

ResultsPlus
Examiner Comments

This answer gained a mark. The candidate clearly refers to all the species/the community and then links this to the habitat.

(ii) State what is meant by the term **ecosystem**.

(1)

different organisms coexisting in a habitat

ResultsPlus
Examiner Comments

This answer did not gain a mark as the candidate does not refer to **all** the organisms.

Question 3 (b)

This longer answer question was well answered by many candidates. Most candidates gained at least two marks with many going on to gain three or four. Most were able to interpret the food web and appreciated how the loss of wolves would affect the populations of other organisms. A few candidates did not refer directly to the organisms in the food web, giving vague references to consumers. Some candidates did not refer back to the diagram and suggested that there would be less decomposition and release of minerals. Few candidates referred to the effect of reduced producers on the rates of photosynthesis and energy transfer. The examiners commented on the excellent standard of answers seen.

(b) Wolves were hunted in this region of North America until they became extinct in 1926.

The extinction of wolves damaged the ecosystem in these ways.

- the population of mice, hawks and beavers decreased
- the population of producer species decreased

Beavers are important in this ecosystem because they cut down old trees and create shelters that other organisms nest in.

Discuss why the extinction of wolves damaged the ecosystem.

(4)

The extinction of wolves damaged the ecosystem because they were hunted by people for ~~the~~ food. This caused a population rise in coyotes ~~and mice which hawks~~ that hunted for mice and beavers. When the mice and beavers were hunted by coyotes their populations declined.

ResultsPlus
Examiner Comments

This answer gained two marks. The candidate explains why the coyote population rises and the effect of this on the populations of mice and beaver. No more explanation was given so no further credit was awarded.

(b) Wolves were hunted in this region of North America until they became extinct in 1926.

The extinction of wolves damaged the ecosystem in these ways.

- the population of mice, hawks and beavers decreased
- the population of producer species decreased

Beavers are important in this ecosystem because they cut down old trees and create shelters that other organisms nest in.

Discuss why the extinction of wolves damaged the ecosystem.

(4)

The extinction of wolves could seriously damage the ecosystem as you are taking out a top predator. Wolves predate on elk and coyote, so without wolves balancing the population of elk and coyote, the elk population and the coyote population will increase, meaning the demand for food that elk eat and the species that coyote prey on will be a lot higher. Due to the high amount of coyotes needing food, ~~animals~~ the population of animals they prey on, like mice, and beavers will decrease. This will also affect the population of hawks as well, because the hawks feed on mice, and there is a smaller population of mice due to coyotes hunting more of them, so the hawks will be left with less food. The extinction of wolves highly disrupts the food chain and population of some species, damaging the ecosystem.

ResultsPlus
Examiner Comments

This answer gained three marks. The candidate clearly explains the increase in population of elk and coyote, the decrease in mice and then goes on to explain how the fall in mouse population affects the hawks.

(b) Wolves were hunted in this region of North America until they became extinct in 1926.

The extinction of wolves damaged the ecosystem in these ways.

- the population of mice, hawks and beavers decreased
- the population of producer species decreased

Beavers are important in this ecosystem because they cut down old trees and create shelters that other organisms nest in.

Discuss why the extinction of wolves damaged the ecosystem.

(4)

With the ~~ex~~tinction of wolves, the predators of coyotes ~~and~~ and elks ~~are~~ were removed. This mean the number of elks and coyotes increase to level not ~~e~~seen before. The increase of elks meant more ~~of~~ aspen trees were consumed by the elks which meant less food for the beavers so their population decreased. The increase of coyotes meant more beavers and mices were eaten so beaver and mice population further decrease. The reduction of ~~thi~~ mice meant less food for the hawk so the ~~haw~~ hawk population decrease.

ResultsPlus
Examiner Comments

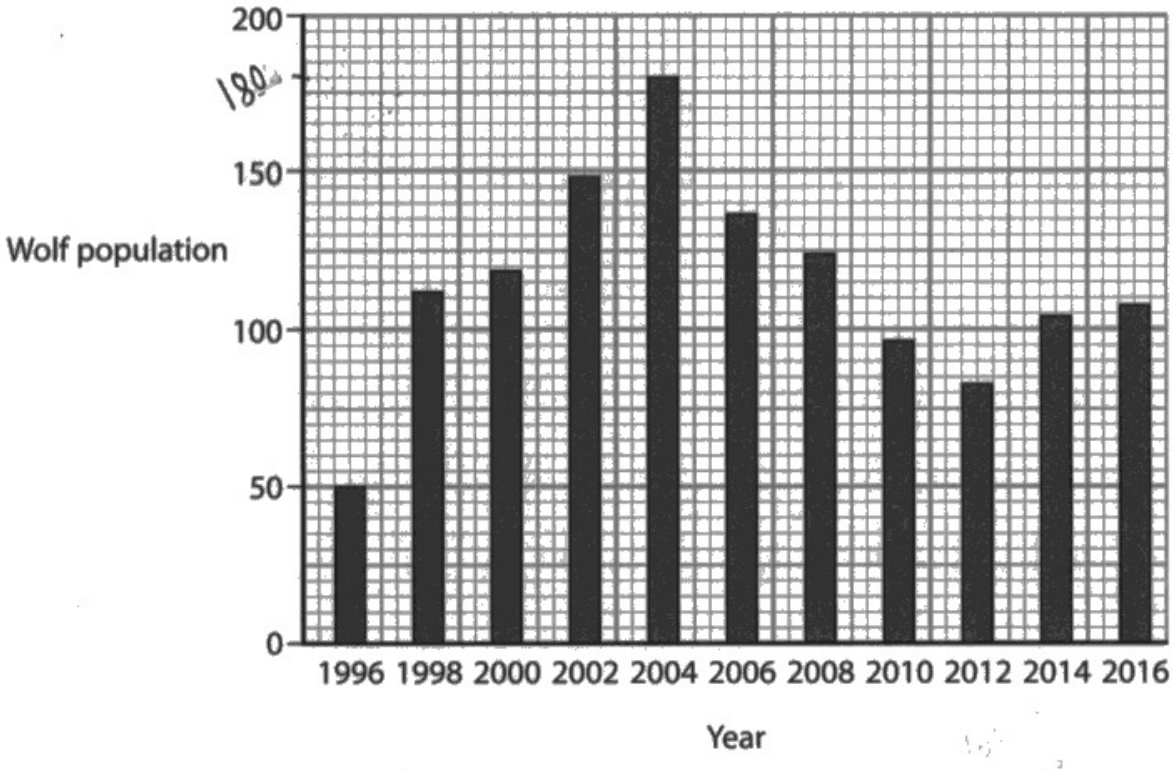
This answer gained all four marks. The candidate explains why the coyote and elk populations increase and goes on to explain the effects of this on the producers, mice and hawks.

Question 3 (c)(i)

Many candidates were able to read values from the graph and go on to complete this calculation. A common error seen was for candidates to divide the wolf population in 2004 by the population in 1996. Candidates should make sure that they understand how to calculate percentages and percentage changes before sitting the examination.

(c) In 1995, 14 wolves were reintroduced to this region.

The diagram shows the change in wolf population from 1996 to 2016.



(i) Calculate the percentage change in the wolf population between 1996 and 2004.

(2)

$\frac{180-50}{180} \times 100 = 72.2\%$

percentage change = 72 %

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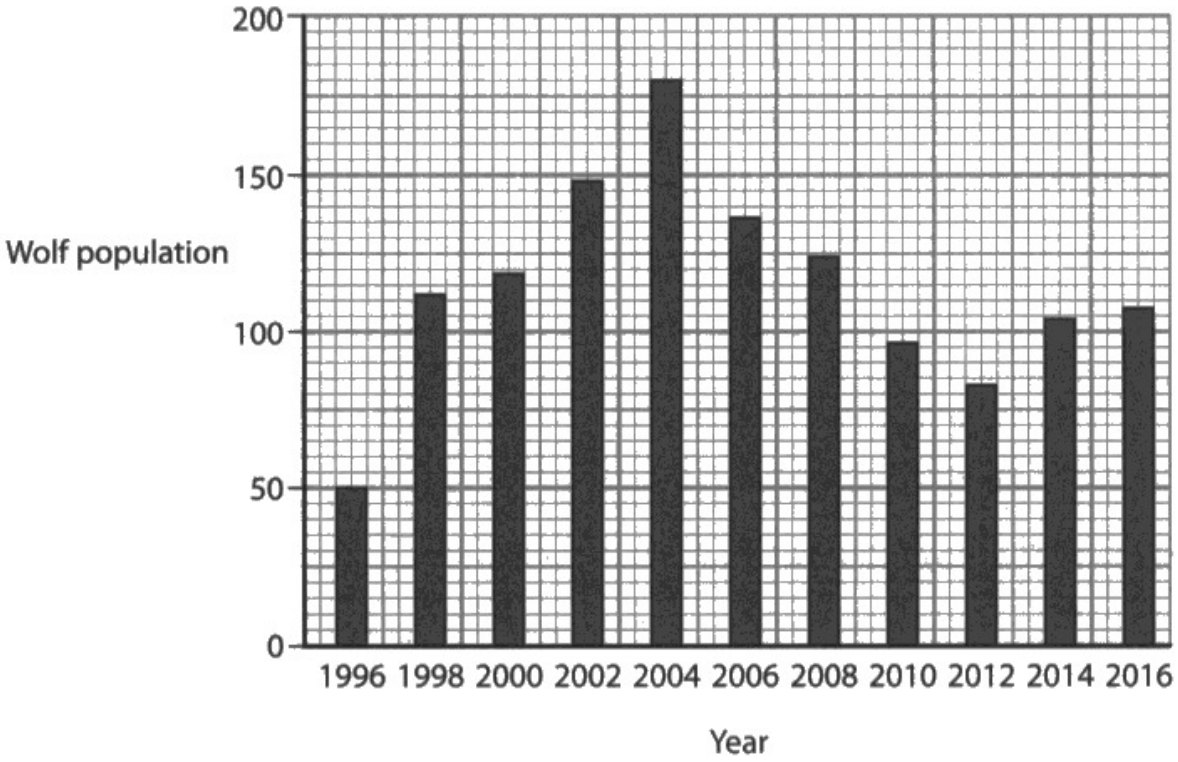
Examiner Comments

This answer gained one mark for correctly subtracting 50 from 180.

(c) In 1995, 14 wolves were reintroduced to this region.

The diagram shows the change in wolf population from 1996 to 2016.



(i) Calculate the percentage change in the wolf population between 1996 and 2004.

(2)

$$\frac{180 - 50}{50} \times 100\%$$

$$= +260\%$$

percentage change = 260 %

ResultsPlus
Examiner Comments

This answer gained both marks. The candidate sets out the calculation well so all the working is clear.

Question 3 (c)(ii)

This answer generated a good range of different responses. Most candidates recognised that a fall in wolf population could be due to reduced food or more competition for food. Around half of candidates were able to give two factors that would cause a decrease in the population. Some candidates misread the graph and thought that the wolf population had increased.

(ii) Suggest why the wolf population changed between 2004 and 2012.

(2)

Other organisms out competed wolves in finding food, shelter and water.
Introduction of new pathogen could have caused a wide spread of disease, which could lead to death of some wolves.
Reproduction rates dropped.

ResultsPlus
Examiner Comments

This is a good answer that gained two marks. The candidate clearly states that competition and new pathogens could have led to a fall in wolf population.

(ii) Suggest why the wolf population changed between 2004 and 2012.

(2)

The ~~wolf~~ wolves may be infected by disease and die.
Some wolves may migrate to other places.
Some wolves may be hunted or killed by predators.

ResultsPlus
Examiner Comments

This answer gained two marks. The candidate clearly suggests that disease and migration would cause the population to fall.

(ii) Suggest why the wolf population changed between 2004 and 2012.

(2)

wolf

Since ~~wolves~~ population increases so much over the years They will have to compete for food. There are not enough food so It decreases till the year 2012. There might have been a natural disaster.

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Examiner Comments

This answer gained one mark for the idea of competition for food. Natural disasters was considered to be too vague for a reason for the population fall.

Question 3 (c)(iii)

Many excellent answers were seen to this question and many candidates had clearly prepared for it after reading the Advance Information. A significant number of candidates gained all three marks. Most were able to describe the use of a quadrat (although candidates should be careful to spell this correctly) and most understood the need for repeats and random sampling. Strong answers went on to explain how the sample would be scaled up to determine the population from a larger area. Where candidates did not score marks it was typically due to misunderstanding what the question required and describing the effect of a change in wolf population on the ecosystem.

(iii) The reintroduction of wolves caused changes in the populations of some plant species.

Describe how the population size of a plant species in the region could be determined.

(3)

By using quadrats of 1 m^2 to some random places throughout the region, counting the plant speaies in each quadrat and repeating it 4 more times to get the average/mean population size of a plant species and then multiply that value by the area of the entire region to get an estimated value.

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Examiner Comments

This answer gained all three marks. The candidate refers to the use of quadrats, carries out repeats and performs the exercise several times. They also refer to the counting of plants and the scaling up of the sample.

(iii) The reintroduction of wolves caused changes in the populations of some plant species.

Describe how the population size of a plant species in the region could be determined.

(3)

The population size could be determined by sampling out from the plant species and using a quadrat for the population size of the plant species in that region. Make sure to place the quadrat randomly for accurate results.

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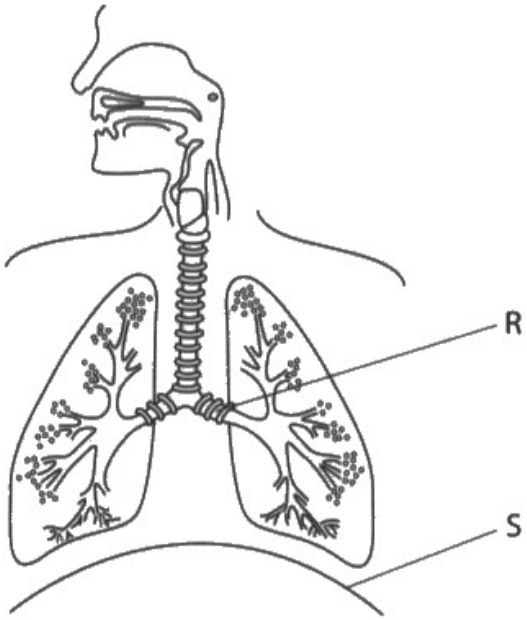
Examiner Comments

This answer gained two marks for the use of a quadrat and the idea of random sampling.

Question 4 (a)(ii)

This question was generally very well answered with many candidates gaining at least one mark and many going on to gain all three. Most appreciated that the diaphragm contracts and moves down, causing an increase in volume and decrease in pressure of the thorax. A few candidates gave vague references to the thorax expanding rather than stating that there was an increase in volume. Some candidates confused inhalation with exhalation and stated that the diaphragm relaxes and moves upwards.

4 (a) The diagram shows part of a human thorax with structures labelled R and S.



(i) What is the name of structure R?

(1)

- ~~A~~ **A** bronchiole
- ☒ **B** bronchus
- ☒ **C** oesophagus
- ☒ **D** trachea

(ii) Explain how changes in structure S enable a person to breathe in.

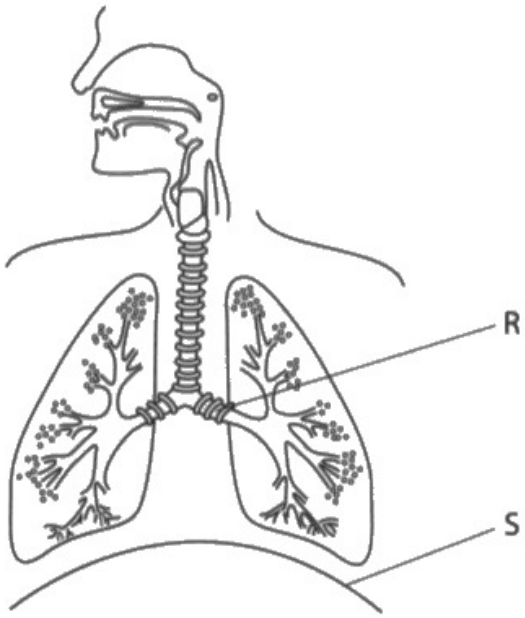
(3)

When a person breathe in, structure S - the diaphragm move ~~down~~ downwards as the thorax volume increase and more gases goes into the lung.

ResultsPlus
Examiner Comments

This answer gained two marks. The candidate has correctly stated that the diaphragm moves down and the volume of the thorax increases.

4 (a) The diagram shows part of a human thorax with structures labelled R and S.



(i) What is the name of structure R?

(1)

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- ☒ **B** bronchus
- ☒ **C** oesophagus
- ☒ **D** trachea

(ii) Explain how changes in structure S enable a person to breathe in.

(3)

Structure S, the diaphragm, allows a person to breathe in, by contracting, as it contracts it pulls down and allows the lungs to expand and fill up with oxygen. As the person breathes out, the diaphragm relaxes, and helps push out all the carbon dioxide out your body.

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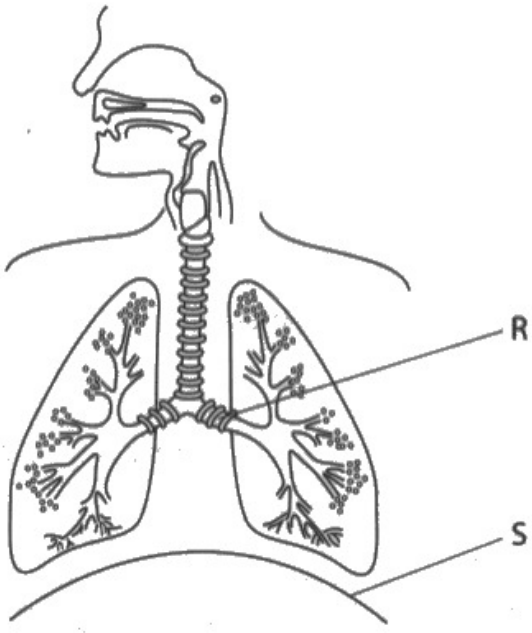
Examiner Comments

This answer gained two marks. The candidate clearly states that the diaphragm contracts and that it moves downwards. There is no mention of an increase in volume or decrease in pressure.

4 (a) The diagram shows part of a human thorax with structures labelled R and S.



(i) What is the name of structure R?

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- ☒ **B** bronchus
- ☒ **C** oesophagus
- ☒ **D** trachea

(ii) Explain how changes in structure S enable a person to breathe in.

(3)

diaphragm flattens and increases the volume of lungs. As the volume of the lungs increase, the presure of the lungs decreases.

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Examiner Comments

This answer uses precise language and gains all three marks. The candidate has clearly stated that the diaphragm flattens and causes an increase in volume and decrease in pressure.

Question 4 (b)(i)

Most candidates were able to correctly state that the independent variable was the cycling speed. A few candidates gave vague references to exercise and others incorrectly stated that the rate of ventilation was the independent variable.

(b) A scientist uses this method to investigate the effect of exercise on the ventilation rate of a person.

Step 1: rest for 10 minutes

Step 2: measure the volume of air in each breath

Step 3: measure the breathing rate

Step 4: ride a bicycle at 15 kilometres per hour for 10 minutes

Step 5: measure the volume of air in each breath

Step 6: measure the breathing rate

The scientist repeats Step 4, Step 5 and Step 6 at increasing cycling speeds.

The table shows some of the results.

Cycling speed in km per hour	Volume of air in each breath in cm^3	Breathing rate in breaths per minute	Ventilation rate in dm^3 per minute
0	500	14	7
15	1500	14	21
20	2000	14	28
25	2500	16	40
30	2600	20	52
35	2600	25	65

(i) State the independent variable in the investigation.

(1)

Rate of ventilation

This answer gained no mark as the candidate has confused the independent and dependent variables.

(b) A scientist uses this method to investigate the effect of exercise on the ventilation rate of a person.

Step 1: rest for 10 minutes

Step 2: measure the volume of air in each breath

Step 3: measure the breathing rate

Step 4: ride a bicycle at 15 kilometres per hour for 10 minutes

Step 5: measure the volume of air in each breath

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The table shows some of the results.

Cycling speed in km per hour	Volume of air in each breath in cm^3	Breathing rate in breaths per minute	Ventilation rate in dm^3 per minute	
0	500	14	7	
15	1500	14	21	7
20	2000	14	28	7
25	2500	16	40	12
30	2600	20	52	12
35	2600	25	65	13

(i) State the ~~independent~~ variable in the investigation.

(1)

cycling speed in km per hour

ResultsPlus
Examiner Comments

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

Question 4 (b)(ii)

This calculation was completed correctly by most candidates. The majority were able to convert between cm^3 and dm^3 and then recognised that they needed to divide the ventilation rate by the breathing rate. A few candidates converted between the units but did not continue the calculation further.

(ii) At a cycling speed of 35 km per hour the person has a breathing rate of 25 breaths per minute.

They also have a ventilation rate of 65 dm^3 per minute.

Calculate the volume of air, in cm^3, in each breath.

[1 dm^3 = 1000 cm^3]

(2)

65 dm^3 = 65000 cm^3

25 × 65000 cm^3 = 1625000

volume = 1625000 cm^3

ResultsPlus
Examiner Comments

This answer gained one mark for the correct conversion of 65 dm^3 to 65 000 cm^3.

(ii) At a cycling speed of 35 km per hour the person has a breathing rate of 25 breaths per minute.

They also have a ventilation rate of 65 dm^3 per minute.

Calculate the volume of air, in cm^3, in each breath.

[1 dm^3 = 1000 cm^3]

(2)

$65 dm^3 = 65000 cm^3$

$\frac{65000 cm^3}{25} = 2600$

volume = 2600 cm^3

ResultsPlus
Examiner Comments

This answer gained both marks. The working is shown clearly – a good example of good practice.

Question 4 (b)(iii)

This question discriminated well. Many excellent answers were seen that identified trends in the breathing rate and change in depth of breathing. Many candidates recognised that increasing the cycling speed would increase the oxygen demand as increased muscle contraction would require a higher respiration rate. Some candidates understood that muscles would be more active but did not refer to the contraction of the muscle. A few candidates gave very vague answers that simply referred to the need for more breathing when exercising more intensively.

(iii) Comment on the effect of increasing cycling speed on ventilation rate.

Refer to the data in the table in your answer.

(4)

When the cycling speed increases the rate of ventilation also increases. The higher the ventilation rate is the more breaths per minute required. At 15 km/h the ventilation rate was 2 l dm^3, while at 30 km/h the ventilation rate was 5 l dm^3 meaning its more than a 100 % increase.

ResultsPlus
Examiner Comments

This answer gained one mark for stating that the ventilation rate increased with exercise. No more detail is given regarding the changes in the volume of each breath or the rate of breathing.

(iii) Comment on the effect of increasing cycling speed on ventilation rate.

Refer to the data in the table in your answer.

(4)

The volume of air in each breath, and the breathing rate increases when cycling speed increases. Ventilation rate also increases. Ventilation rate is lowest when the cyclist is stationary. It's the highest when the cycling speed is at 35 km/h. It increases steadily as the cycling speed is increased.

ResultsPlus
Examiner Comments

This answer gained two marks. The increase in overall rate of ventilation has been given along with the increasing volume of air in each breath.

(iii) Comment on the effect of increasing cycling speed on ventilation rate.

Refer to the data in the table in your answer.

(4)

As cycling speed increase ventilation increases. This is because as cyclists moves his muscles more. More respiration happens, and more heat is caused. heat energy increases. The body cools itself by ventilation. The body respires aerobically more. More CO_2 is released.

ResultsPlus
Examiner Comments

This answer gained two marks. The candidate correctly stated that the ventilation rate increases as does the respiration rate. No reference to oxygen transport has been given and although muscle activity is mentioned, there is no mention of contraction.

Question 4 (b)(iv)

Most candidates recognised that to make the experiment more reliable, more repeats would have to be carried out.

(iv) State how the scientist could make the investigation more reliable.

(1)

Repeat this with multiple ~~pople~~ people.

ResultsPlus
Examiner Comments

This answer gained one mark for the idea of repeats.

(iv) State how the scientist could make the investigation more reliable.

(1)

Same ~~temperth~~ temperature ~~dodoing~~ doing the test.

ResultsPlus
Examiner Comments

This answer gained no credit as the candidate has confused the idea of a fair test with reliability.

Question 5 (a)(i)

Many candidates found giving a formal definition of a gene challenging. Many vague answers were seen, such as genes coding for characteristics or affecting the phenotype. Strong answers that gained credit referred to sections of DNA that code for proteins.

5 The photograph shows a variety of chicken called a silkie chicken.

(Source: © YVES LANCEAU/NATURE PICTURE LIBRARY/SCIENCE PHOTO LIBRARY)

Silkie chickens have feathers that have a fluffy appearance.

Feather structure is controlled by a single gene.

The allele for producing silkie feathers (f) is recessive to the allele for producing normal feathers (F). dominant

(a) (i) State what is meant by the term **gene.**

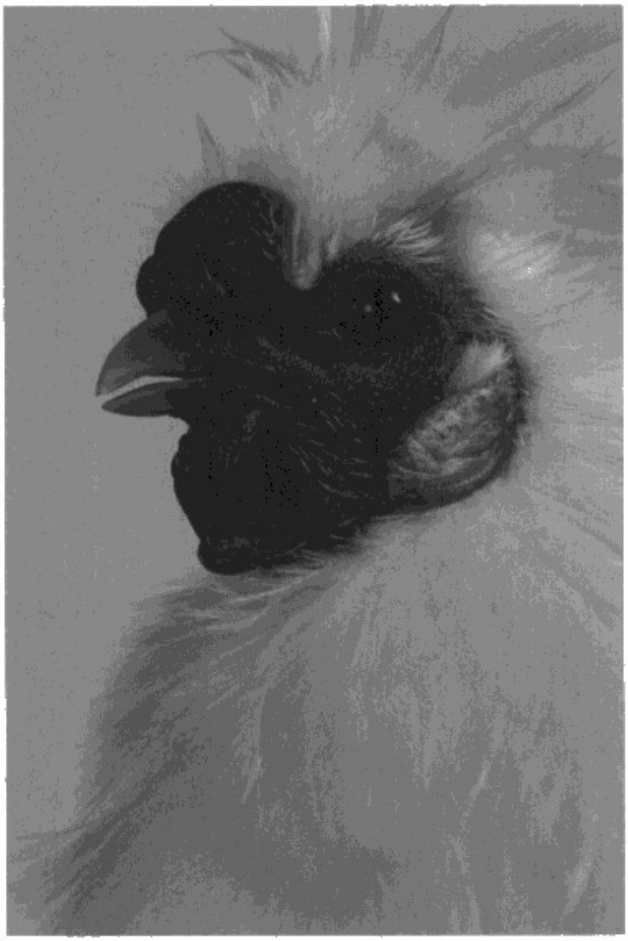
(1)

Gene is a section of DNA that codes for a particular protein, characteristic or feature.

ResultsPlus
Examiner Comments

This is an example of a correct definition of a gene that gained one mark.

5 The photograph shows a variety of chicken called a silkie chicken.



(Source: © YVES LANCEAU/NATURE PICTURE LIBRARY/SCIENCE PHOTO LIBRARY)

Silkie chickens have feathers that have a fluffy appearance.

Feather structure is controlled by a single gene.

The allele for producing silkie feathers (f) is recessive to the allele for producing normal feathers (F).

(a) (i) State what is meant by the term **gene**.

(1)

The characteristics / features that inherited from parents.

ResultsPlus
Examiner Comments

This is an example of a common error that candidates made.

Question 5 (a)(ii)

Most candidates were able to correctly give FF and Ff as all the genotypes that would give normal feathers. A few candidates gave hh in addition.

(ii) Give the possible genotypes of a chicken with normal feathers.

(1)

FF

ResultsPlus
Examiner Comments

This example did not gain any credit. There is no mention of Ff.

(ii) Give the possible genotypes of a chicken with normal feathers.

(1)

FF & Ff

ResultsPlus
Examiner Comments

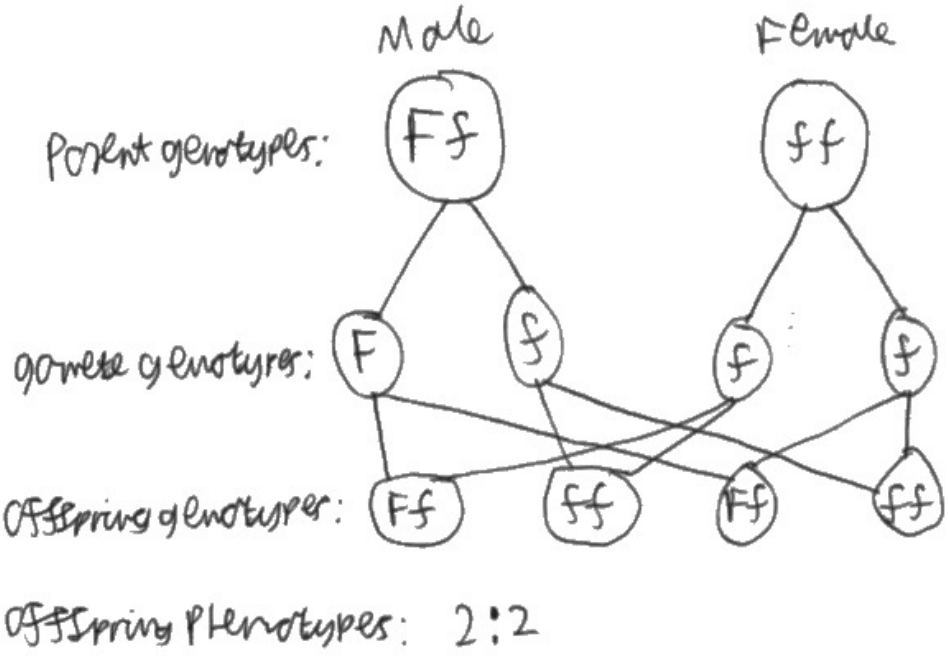
This example shows a correct response as the candidate has stated FF and Ff. One mark was awarded.

Question 5 (b)(ii)

Many candidates scored at least two marks. The examiners were impressed with the high quality of many of the genetic diagrams shown. A few candidates gave incorrect parental genotypes (often Ff and Ff) and others gave gametes which contained two alleles. Candidates should try to draw genetic diagrams neatly and clearly label the genotypes and gametes.

(ii) Use a genetic diagram to determine the probability of one of the offspring of individual 6 and individual 7 being a chicken with silkie feathers.

(4)



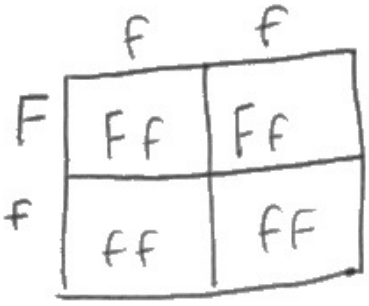
probability = 50%

ResultsPlus
Examiner Comments

This answer gained four marks. The diagram is neat and well organised and the genotypes and gametes are clear.

(ii) Use a genetic diagram to determine the probability of one of the offspring of individual 6 and individual 7 being a chicken with silkie feathers.

(4)



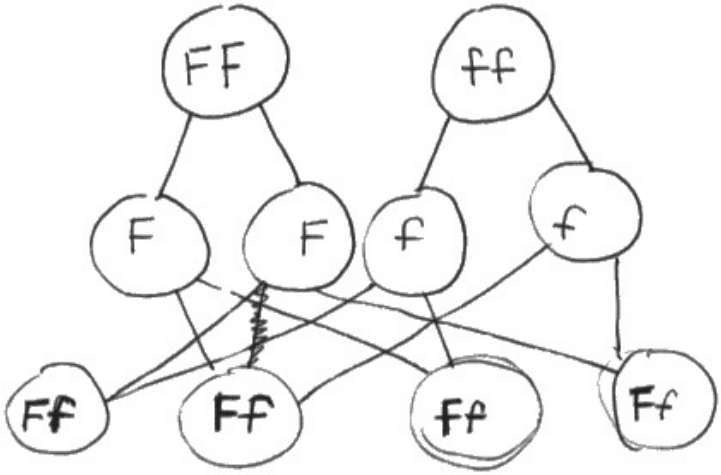
probability = 1/2

ResultsPlus
Examiner Comments

This answer gained four marks. The candidate has drawn the diagram neatly and although they have not labelled gametes, it is clear that they have used them correctly.

(ii) Use a genetic diagram to determine the probability of one of the offspring of individual 6 and individual 7 being a chicken with silkie feathers.

(4)



probability = 0%

ResultsPlus
Examiner Comments

This answer gained two marks. One of the parental genotypes is incorrect. The rest of the cross has been carried out correctly so two marks were awarded.

ResultsPlus
Examiner Tip

Draw genetic diagrams clearly. Label gametes, genotypes and phenotypes.

Question 5 (b)(iii)

This was a challenging question but many candidates were able to gain at least one mark. Only a minority of candidates recognised that height of chickens would be polygenic and so have several genes affecting it. Where candidates did score credit, it was frequently due to referring to environmental factors such as diet.

(iii) The scientist observes that the chickens have either normal feathers or silkie feathers.

However, the chickens have a wide range of different heights.

Explain why there is a wider range of variation in height than in feather type.

(3)

- This is due to height being both a natural and environmental factor.
- As such, factors such as nutrition and health may stunt potential height, whereas the feather type is solely dictated by the genetics
- In addition, there are more genes responsible for differences in height.

(Total for Question 5 = 10 marks)

ResultsPlus
Examiner Comments

This is a good answer that gained two marks. The candidate has explained that the environment affects height and also stated that many genes also affect height.

(iii) The scientist observes that the chickens have either normal feathers or silkie feathers.

However, the chickens have a wide range of different heights.

Explain why there is a wider range of variation in height than in feather type.

(3)

Height is a ~~characteristic~~ polygenic characteristics controlled by a variety of genes. ~~This~~ The genes add with each other. This cause intermediate expression, a range of heights. The environmental factors could also affect height. It depends on the chicken's minimal surroundings.

ResultsPlus
Examiner Comments

This excellent answer gained all three marks. The candidate states that height is polygenic, defines polygenic and also refers to the role of the environment.

ResultsPlus
Examiner Tip

If you use technical terms such as polygenic, always state what the terms mean.

(iii) The scientist observes that the chickens have either normal feathers or silkie feathers.

However, the chickens have a wide range of different heights.

Explain why there is a wider range of variation in height than in feather type.

(3)

Feather type is a discontinuous variable so there can only be a ~~certain~~ certain ~~gene~~ number of ~~certain~~ alleles for each feather type. However, height is a continuous variable as there can be an extremely wide range of heights so there are many more alleles which account for a wider variation in height.

ResultsPlus
Examiner Comments

This answer gained one mark for stating that feather type is discontinuous variation.

Question 6 (a)(ii)

Many candidates found this question surprisingly challenging. Although there were many answers that gained all three marks, a signifcant number were unable to state that amylase digests starch into maltose. Many referred to carbohydrates rather than starch – candidates should try to give specific details in their answers rather than use broad terms.

(ii) Table 1 gives the names of some enzymes, the molecules they digest, and the products formed.

Complete Table 1 by giving the missing information.

(3)

Enzyme	Molecule	Product
amylase	~~amylase~~ starch	maltose
lipase	lipid	glycerol + 3 fatty acids
protease	protein	amino acids / peptides

Table 1

ResultsPlus
Examiner Comments

This answer gained all three marks. The correct enzymes, substrates and products are all given.

(ii) Table 1 gives the names of some enzymes, the molecules they digest, and the products formed.

Complete Table 1 by giving the missing information.

(3)

Enzyme	Molecule	Product
Amylase	carbohydrates	maltose
Lipase	lipid	fatty acids
protease	protein	amino acids

Table 1

ResultsPlus
Examiner Comments

This answer gained two marks. Carbohydrate was too vague for the molecule digested by amylase so no mark was awarded for that row.

ResultsPlus
Examiner Tip

Be careful with spellings. If the spelling of a word can be mistaken for another word, the mark will not be awarded. For example, ligase would not be accepted for lipase.

Question 6 (b)(i)

This calculation was completed well by the majority of candidates to gain two marks. A few were able to determine that 4g of lentils would give 4g of protein but then forgot to multiply this by 46g mass of protein required.

(b) Table 2 shows the recommended daily amounts (RDA) of some dietary components for a person.

Table 2 also shows the actual amounts of these dietary components in a person's diet in one day.

	Amount of dietary component						
	Energy in kJ	Protein in g	Vitamin A in mg	Vitamin C in mg	Calcium in mg	Iron in mg	Fibre in g
RDA	2200	46	0.70	65	1300	15	26
Diet of person	2700	46	0.72	32	800	16	12

Table 2

(i) One 100 g serving of lentils provides 25 g of protein.

Calculate the mass of lentils that contains 46 g of protein.

(2)

100 ÷ 25 = 4

46 × 4 = 184 g

mass of lentils = 184 g

ResultsPlus
Examiner Comments

This correct answer gained both marks. The candidate has shown their working clearly.

(b) Table 2 shows the recommended daily amounts (RDA) of some dietary components for a person.

Table 2 also shows the actual amounts of these dietary components in a person's diet in one day.

	Amount of dietary component						
	Energy in kJ	Protein in g	Vitamin A in mg	Vitamin C in mg	Calcium in mg	Iron in mg	Fibre in g
RDA	2200	46	0.70	65	1300	15	26
Diet of person	2700	46	0.72	32	800	16	12

Table 2

(i) One 100 g serving of lentils provides 25 g of protein.

Calculate the mass of lentils that contains 46 g of protein.

(2)

×4

100g : 25g

1g : 0.25g

184g : 46g

×4

mass of lentils = 184 g

ResultsPlus
Examiner Comments

This answer also gains two marks. The candidate has used a slightly different method to the other example but the final answer is also correct.

Question 6 (b)(ii)

This question discriminated well and generated an excellent range of marks. Strong answers identified which of the nutrients were present in sufficient quantities, which were deficient, and which were in excess and then went on to explain the consequences of each. Some candidates only considered nutrients that had a deficiency. A few candidates gave the effects of the diet (e.g. constipation) without linking the effects to specific nutrients. Some candidates gave confused particular deficiency diseases with the wrong nutrient groups, for example incorrectly linking scurvy with calcium. The examiners all commented on the progress that candidates have made with these longer, discussion style questions.

(ii) Discuss the possible long-term effects of this person eating the same diet every day.

(5)

This person obtains less vitamin C than required which could cause scurvy or bleeding gums. It would also cause a slower repairing of ~~blood vessels~~ cells as ~~less~~ vitamin C ~~aids~~ helps with repairing of cell lining. They also obtain less fibre which means less peristalsis throughout their digestive system, putting them at risk for having diarrhea. Additionally, they obtain less calcium which affects their bone strength and development. There is less calcium to work with vitamin D to support the bones which could cause weakness and fragility in bones. They are also obtaining more energy than required which could result in obesity. This is because there is more energy to be stored ~~as~~ as fat in cells; there is more energy than the person needs. Eating the required or more amounts of protein, vitamin A and iron allows for growth, good vision and ~~ability to carry a good amount of~~ less risk of breathlessness as there is enough haemoglobin to bind to oxygen.

ResultsPlus
Examiner Comments

This excellent answer gains five marks. The candidate explains the effects of vitamin C, fibre, vitamin D deficiencies and also states that an excess in energy would lead to obesity. The candidate has also discussed the effects of those nutrients that are present in sufficient quantities.

ResultsPlus
Examiner Tip

If a question asks candidates to 'discuss' information, candidates should explore all aspects of the information.

(ii) **Discuss the possible long-term effects of this person eating the same diet every day.**

(5)

Eating the same diet everyday can cause this person to have issues ~~with~~ as they lack Vitamin C, Calcium and Fibre. Having a lack of calcium ~~as~~ creates a weakness in your bones and teeth as Calcium makes them stronger. With them stronger the person is less likely to have them broken. Having a lack of vitamin C can cause a lack of nutrition and decrease in health.

ResultsPlus
Examiner Comments

This answer gained one mark. The candidate has correctly stated that a lack of calcium would lead to weaker bones but gives no further detail.

(ii) Discuss the possible long-term effects of this person eating the same diet every day.

(5)

- increase in weight due to ~~one~~ diet being higher in energy than recommended amounts
- constipation due to ~~not~~ not enough roughage consumed
- ~~weak~~ weak bones due to not enough calcium consumed or rickets
- scurvy due to not enough vitamin C consumed
- ~~good~~ good vision due to consuming enough vitamin A
- efficient gas exchange as the person consumes more iron which is needed for the production of haemoglobin

ResultsPlus
Examiner Comments

This is an excellent answer that gained all five marks. The candidate discusses each nutrient group in detail.

(ii) Discuss the possible long-term effects of this person eating the same diet every day.

(5)

They might not get enough vitamin C as they are consuming half of the recommended amount, so they may develop scurvy. ~~be~~ They are also consuming 500 mg less than the recommended amount of calcium which is needed for bone growth so that may decrease / they may develop rickets. They are also consuming less than half the recommended amount of fibre so they may experience constipation as fibre helps food along the gut.

However, they may be able to build muscle as they are eating enough protein, and they are not likely to develop anaemia due to lack of iron.

ResultsPlus
Examiner Comments

This strong answer gained all five marks. The candidate has considered both deficiencies, excess and sufficient amounts of each nutrient.

(ii) Discuss the possible long-term effects of this person eating the same diet every day.

(5)

1. The person does not take in ~~enough~~ enough amount of vitamin C. (33mg) Lack of vitamin C ~~for~~ could lead to scurvy. Vitamin C enhances our immune system. , deficiency of vitamin C ~~for~~ could leads to a decline of immunity in long term.

2. The person does not have enough fibre, ~~it only~~ 14g less everyday compare to RDA. this person might have difficulties with ejection.

3. The person obtains 700mg less of calcium everyday. The calcium plays an important role on bone development , the person might face ricket or easy fractured bone in ~~the~~ ~~the~~ the future.

ResultsPlus
Examiner Comments

This answer gained three marks. Vitamin C, fibre and calcium deficiencies are discussed but no more nutrients are considered.

Question 6 (b)(iii)

This question was well answered with most candidates gaining at least one mark and many went on to gain a second mark. Typical correct answers included age, pregnancy, activity levels and sex. Candidates should be careful to give precise answers, for example, body mass was a correct answer but simply stating size was not accepted.

(iii) Suggest two reasons why the RDA for energy may not be the actual amount required by this person.

(2)

1 It does not take into account ~~a person~~ the person's age.

2 Someone who is ~~pregnat~~ pregnant might need more than the RDA.

ResultsPlus
Examiner Comments

This gained both marks. The candidate has correctly stated that age and pregnancy will affect the RDA.

(iii) Suggest two reasons why the RDA for energy may not be the actual amount required by this person. height mass

(2)

1 We don't know the weight of this person

2 We don't know the height of this person

ResultsPlus
Examiner Comments

This answer gained one mark for the weight of a person. Height is a similar idea to weight.

ResultsPlus
Examiner Tip

If asked for two reasons, make sure that they are distinct from each other.

Question 7 (a)

Over half of the candidates were able to state that organs are collections of different tissues. A significant number of candidates confused the definition of a tissue with organs and suggested that they are collections of similar cells. Some candidates gave vague descriptions that suggested that the skin is classed as it has a function in thermoregulation.

7 The skin is an organ involved in temperature regulation.

(a) State why the skin is described as an organ.

(1)

it is a collection of different tissues working together to achieve a function.

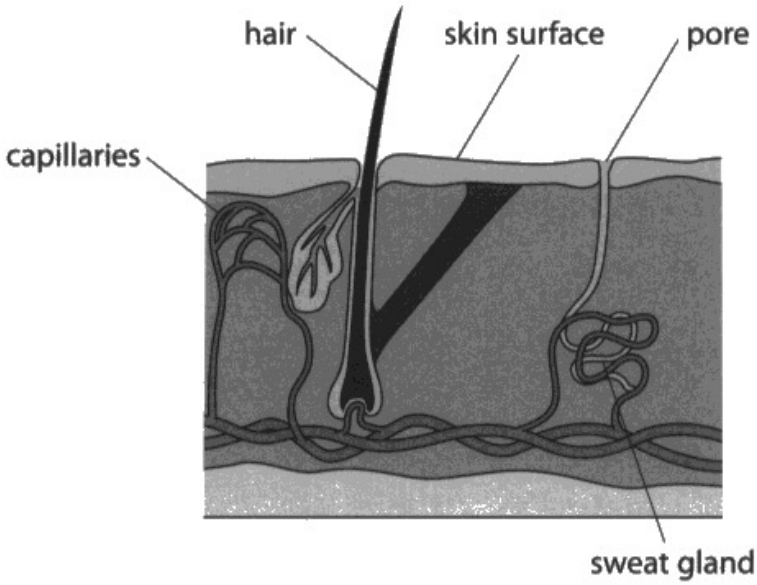
ResultsPlus
Examiner Comments

This answer gained a mark as the candidate has correctly stated that skin is an organ as it is a collection of tissues.

Question 7 (b)(i)

Many candidates found this question very challenging and so did not score credit. A large number incorrectly stated that the capillaries (rather than the arterioles) undergo vasodilation and that this occurs causing the capillary to widen. A significant number of candidates also suggested that the capillaries move rather than stating that there is an increased blood flow to the surface of the skin. Strong answers explained that blood vessels (or arterioles) undergo vasodilation causing increased blood flow to the skin surface resulting in increased heat loss from radiation.

(b) The diagram shows a section of human skin.



(i) Explain how the skin capillaries regulate body temperature when the body temperature increases.

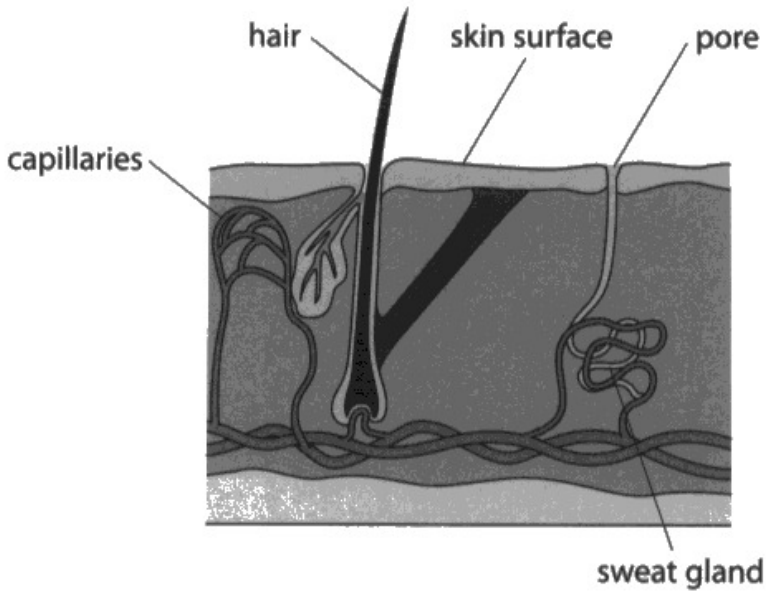
(3)

When body temperature increases, the capillaries in the skin vaso dilate – this means they widen their lumen to allow more blood to flow through them. This helps increase the amount of heat lost from our bodies, and so lowers our body temperature.

ResultsPlus
Examiner Comments

This answer was awarded two marks for the idea of increased blood flow through the capillaries and increased heat loss. Vasodilation was not awarded as it was linked to the capillaries.

(b) The diagram shows a section of human skin.



(i) Explain how the skin capillaries regulate body temperature when the body temperature increases.

(3)

When body temperature increases the skin capillaries vasodilate which increases the blood flow in the skin capillaries, this results in more heat loss through radiation.

ResultsPlus
Examiner Comments

This answer was awarded three marks. No mark was awarded for vasodilation but three marks were awarded for increased blood flow, heat loss and radiation.

Question 7 (b)(ii)

This question generated an excellent range of responses. Candidates are generally well prepared for experimental planning questions and many scored five or six marks. Candidates should try to give full experimental details and be clear what they are changing and what they keep the same. A few candidates wrote very brief answers such as 'Change – drink temperature, Same – exercise'. Although it is excellent practice to include their plan using the CORMS structure, candidates should still write an experimental procedure. No marks are awarded for the quality of written communication but it needs to be clear what the candidate is planning to do. Candidates should also refer to volumes and masses rather than the vague term 'amount.'

(ii) Some people have suggested that drinking warm drinks may cool the body because it increases the rate of sweat production.

Design an investigation to determine whether drinking warm drinks increases the rate of sweat production.

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

(6)

Select some people with same age and gender. Give them drinks with different temperature. But the drink should be of same volume and same type. Measure the amount of sweat production. Repeat the experiment with a different age group and measure their rate of sweat production and calculate average.

ResultsPlus
Examiner Comments

This is a good answer that gained four marks. The candidate states that they will use the same people, have one person with hot and one with cold drinks and goes on to say that they will carry out repeats and control the volume of drink. The suggested measure of measuring sweating is too vague.

(ii) Some people have suggested that drinking warm drinks may cool the body because it increases the rate of sweat production.

Design an investigation to determine whether drinking warm drinks increases the rate of sweat production.

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

(6)

CORMS

C : One person drinks warm drink and the other person doesn't.

O : The two people involved in the experiment must be the same age and have similar ~~me~~ weight.

R : Repeat the experiment for 3 times.

M_1 : Measure the volume of sweat produce by the 2 people

M_2 : Measure the volume of sweat ~~after~~ 15 minutes after drinking warm drinks.

S_1 : The temperature of the place ~~when~~ where the people stay needs to be the same.

S_2 : The volume of warm drink in every experiment needs to be the same.

ResultsPlus
Examiner Comments

This is an excellent answer that gained six marks (ORMMSS). The candidate has structured their answer in terms of CORMS but in doing so has given full detail to explain each aspect. For example, they have stated that the people used will be the same age. They have clearly stated that they will measure the volume of sweat produced rather than simply suggesting measuring the amount.

(ii) Some people have suggested that drinking warm drinks may cool the body because it increases the rate of sweat production.

Design an investigation to determine whether drinking warm drinks increases the rate of sweat production.

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

(6)

Firstly the temperature of the room must be kept the same (control Variable)

Take the temperature of participants before making a participant drink. (using a thermometer)

Give participant's drinks that are different temperatures (e.x. warm, cold) wait a certain amount of time before measuring their temperature again.

Record the results and calculate the mean. Repeat the experiment at least 3 times and compare the means.

ResultsPlus
Examiner Comments

This answer gained three marks for changing the temperature of the drink (C), having same room temperature (S) and doing repeats (R)

Question 8 (a)(i)

Most candidates were able to correctly identify at least one variable kept the same in the experiment, often the volume of water or the lamp. Some candidates gave other variables that were not listed in the method (the question asked for variables that were actually kept constant, not others). Some candidates also referred to the amount of water or simply the water, both of which were not equivalent to the volume of water.

8 A student uses this method to investigate the effect of fertiliser on the growth of plant seedlings.

- set up two trays with an equal mass of compost in each tray
- plant 100 seeds, equally spaced, in each tray
- place the trays under the same lamp until the seeds start to germinate
- water each tray every day with the same volume of water
- add fertiliser to one of the trays every day
- remove five seedlings from each tray every four days for a period of 20 days
- dry these seedlings in an oven and find their mass

The table shows the student's results.

Day	Dry mass of seedlings in g	
	Without fertiliser	With fertiliser
4	3.5	3.8
8	4.9	5.8
12	5.8	6.7
16	6.3	7.8
20	6.8	8.5

(a) (i) Give two abiotic variables that the student controls.

(2)

1 temperature, light intensity

2 volume of water

ResultsPlus
Examiner Comments

This answer gained two marks for the light intensity and the volume of water.

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12	5.8	6.7
16	6.3	7.8
20	6.8	8.5

(a) (i) Give two abiotic variables that the student controls.

(2)

1 Number of seedlings dried in the oven

2 The lamp

ResultsPlus
Examiner Comments

This answer gained one mark for the lamp. Number of seedlings was not given credit as the question asked for abiotic variables.

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8	4.9	5.8
12	5.8	6.7
16	6.3	7.8
20	6.8	8.5

(a) (i) Give two abiotic (non living) variables that the student controls.

(2)

1 light intensity

2 amount of water during watering

ResultsPlus
Examiner Comments

This answer gained one mark for the light intensity. Amount of water was not equivalent to volume.

Question 8 (a)(ii)

This was a challenging question and only stronger candidates gained full marks. A significant number of candidates recognised that the water content of seeds would vary but very few explained that the mass of water does not represent biomass. Many candidates simply stated that the dry mass is the mass of the seedlings without water.

(ii) The student dries the seedlings in an oven to find their dry mass.

Suggest why it is important to use dry mass in this investigation.

(2)

To have the normal mass and to have a valid comparison.

ResultsPlus
Examiner Comments

This answer gained one mark for the idea of ensuring that there was a valid comparison.

(ii) The student dries the seedlings in an oven to find their dry mass.

Suggest why it is important to use dry mass in this investigation.

(2)

So that it is a fair test because some seedlings may have a different ~~amount~~ amount of water each.

ResultsPlus
Examiner Comments

This answer gained one mark for the idea of water content being different.

(ii) The student dries the seedlings in an oven to find their dry mass.

Suggest why it is important to use dry mass in this investigation.

(2)

water content of seedlings may vary depending on their conditions and the time of day that the measurement is taken at. Using a dry mass ensures that the experiment is valid.

ResultsPlus
Examiner Comments

This answer gained two marks for the idea of water content being variable and it is essential to use dry mass to make the comparison valid.

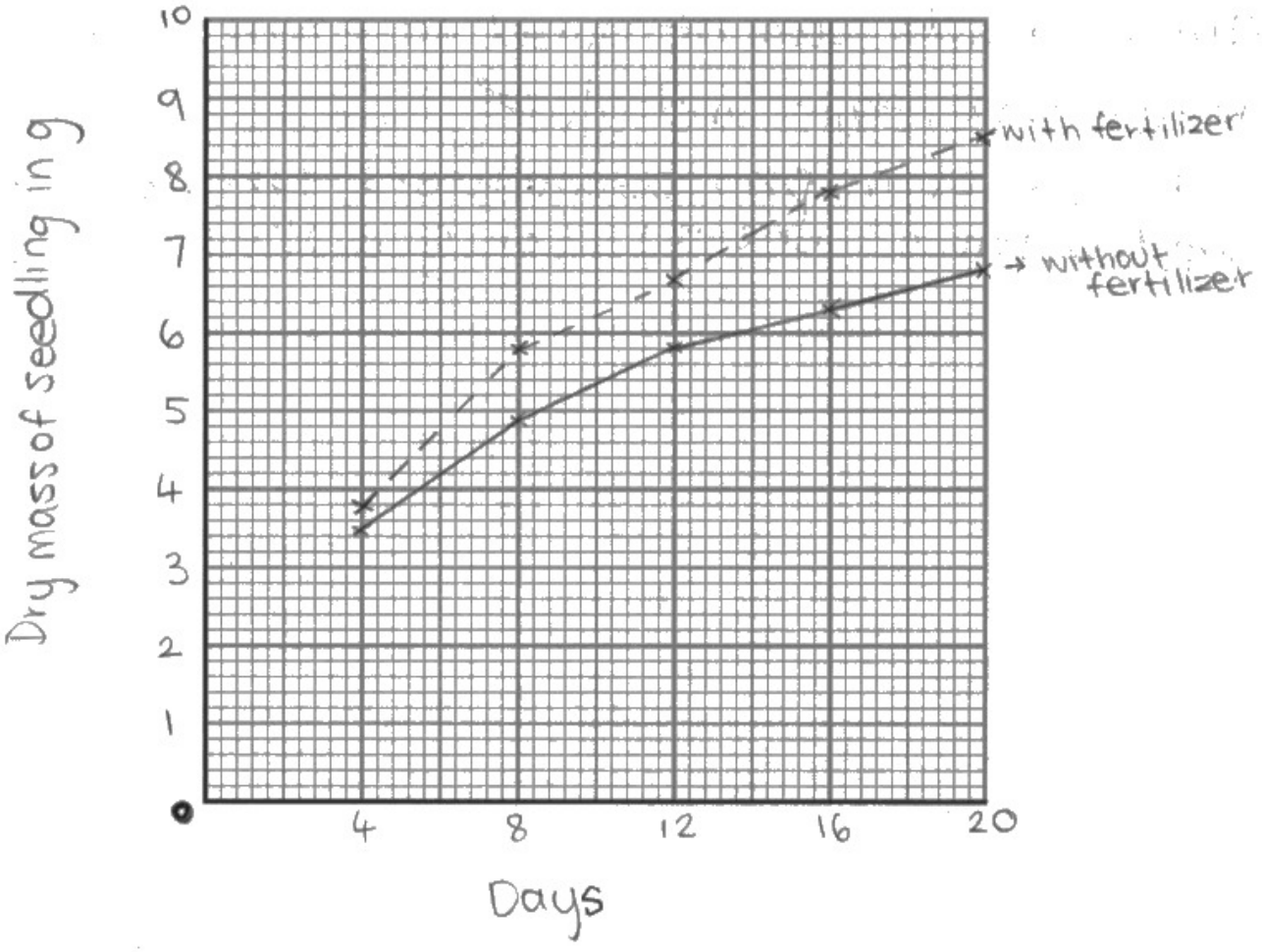
Question 8 (b)(i)

This question required candidates to plot three sets of data on a graph and join the points with straight lines. Most candidates produced excellent graphs and scored at least four marks. Most selected appropriate linear scales although a few chose unusual increments – it is good practice to select increments that are easy to use (for example 2s, 5s, 10s, 25s) so that candidates are less likely to make errors when plotting points. The majority of candidates labelled axes correctly and were able to join the points with ruled, straight lines. Candidates should not extrapolate the lines beyond the first and last point.

(b) (i) Plot a line graph to show the dry mass of seedlings without fertiliser and the dry mass of seedlings with fertiliser, from day 4 to day 20.

Use a ruler to join your points with straight lines.

(5)



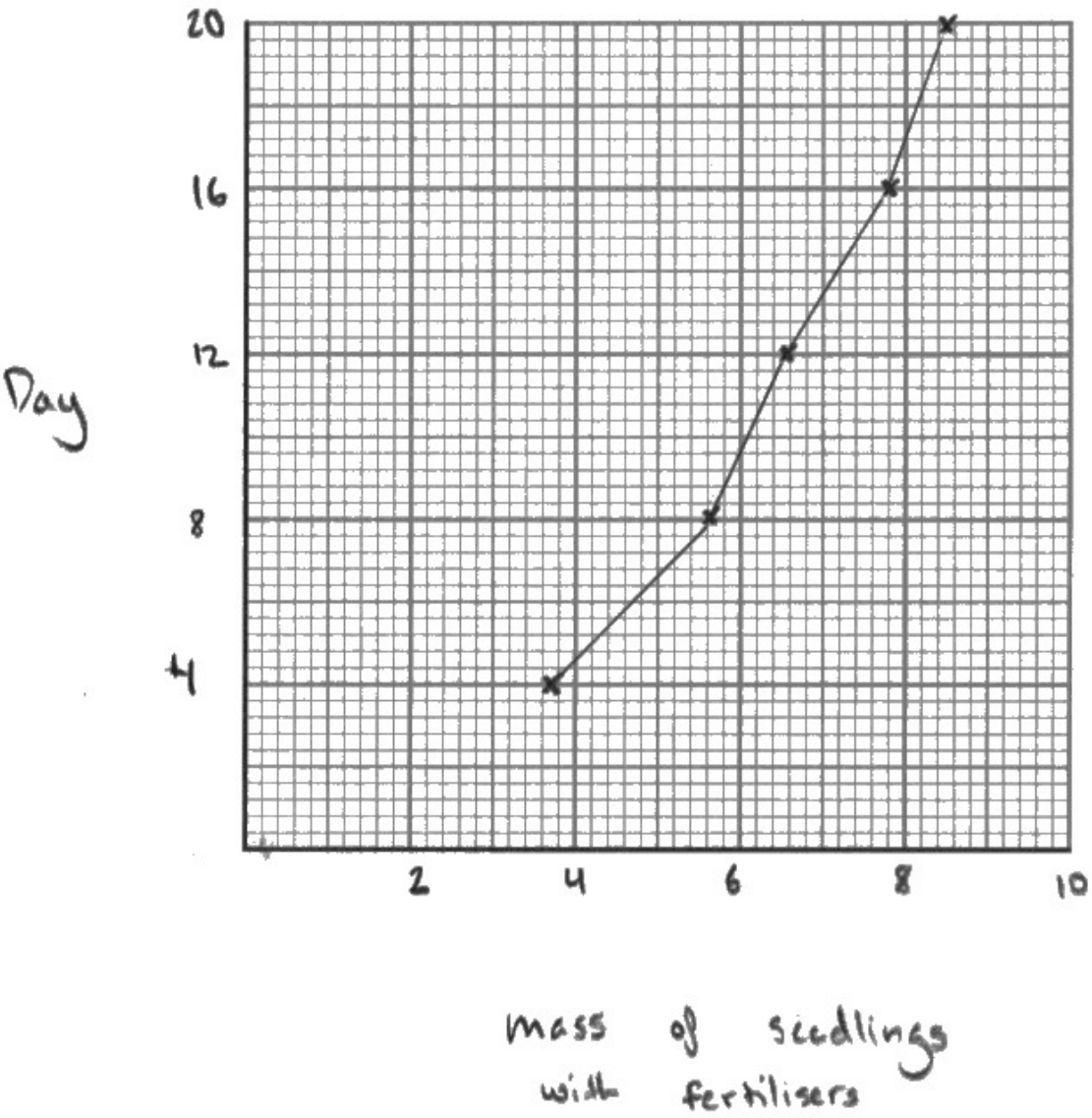
ResultsPlus
Examiner Comments

This excellent graph gained all five marks. The candidate has labelled the axes, drawn a key, plotted the points correctly and joined the points with straight lines.

(b) (i) Plot a line graph to show the dry mass of seedlings without fertiliser and the dry mass of seedlings with fertiliser, from day 4 to day 20.

Use a ruler to join your points with straight lines.

(5)



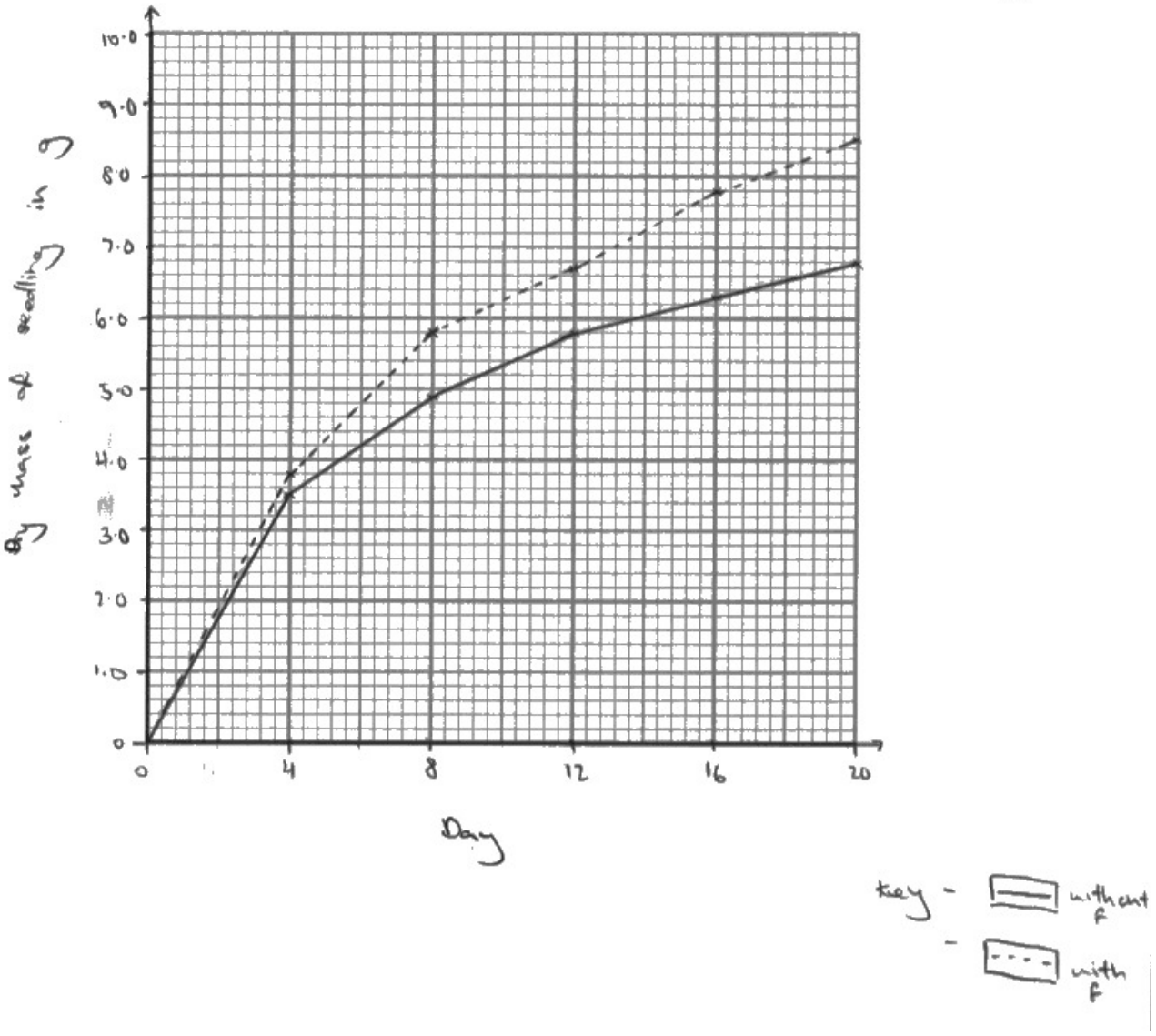
ResultsPlus
Examiner Comments

This graph gained only one mark. The axes are the wrong way round, no units are given on the axes and only one set of data has been plotted. One mark was awarded for joining the points with straight lines.

(b) (i) Plot a line graph to show the dry mass of seedlings without fertiliser and the dry mass of seedlings with fertiliser, from day 4 to day 20.

Use a ruler to join your points with straight lines.

(5)



ResultsPlus
Examiner Comments

This graph gained four marks. The candidate has extrapolated the line to the origin so no mark was awarded for the line.

ResultsPlus
Examiner Tip

Do not extrapolate graphs beyond the first and last point.

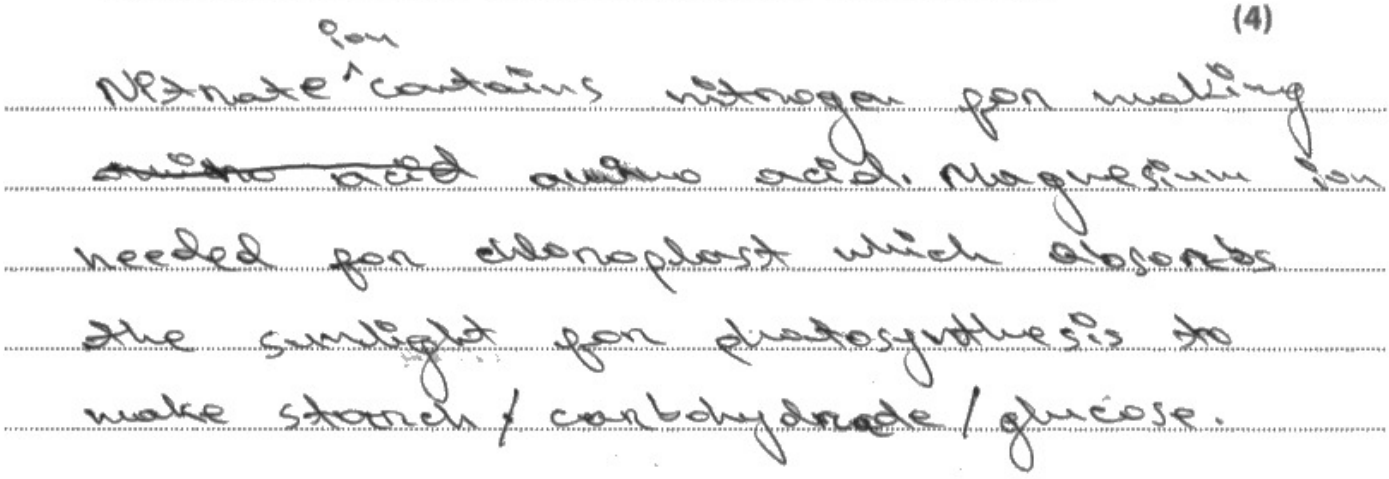
Question 8 (b)(ii)

This question discriminated well. Strong answers described the roles of magnesium and nitrates in producing chlorophyll and amino acids respectively, explaining that they are necessary for photosynthesis and protein synthesis. Weaker answers tended to focus on one of the two mineral ions or did not explain their roles, for example, many stated that magnesium is essential for chlorophyll production but did not go on to explain that this is needed for photosynthesis.

(ii) The fertiliser contains magnesium ions and nitrate ions.

Explain the effect of these two ions on the growth of the seedlings.

(4)



ResultsPlus
Examiner Comments

This answer gained all four marks. The candidate states that magnesium and nitrates are needed to make chlorophyll and amino acids and goes on to explain the role of chlorophyll in photosynthesis.

(ii) The fertiliser contains magnesium ions and nitrate ions.

Explain the effect of these two ions on the growth of the seedlings.

(4)

magnesium ion help to make chlorophyll which helps the seedlings to photosynthesis and produce glucose and ATP.

Nitrate ion help to produce amino acid with build proteins

ResultsPlus
Examiner Comments

This excellent answer gained all four marks. It is written in a logical sequence and it is easy to spot all four mark points.

ResultsPlus
Examiner Tip

Write answers in logical order – it makes it easier to see if you have gained all the mark points.

(ii) The fertiliser contains magnesium ions and nitrate ions.

Explain the effect of these two ions on the growth of the seedlings.

(4)

Magnesium ions provide ~~protein~~ protein. Nitrate ions provide amino acids. These will help increase the growth of the seedlings as they are important nutrients.

ResultsPlus
Examiner Comments

This answer gained one mark for the role of nitrate in amino acid production.

(ii) The fertiliser contains magnesium ions and nitrate ions.

Explain the effect of these two ions on the growth of the seedlings.

(4)

These two ions could provide nutrients for the seedlings to aid with their growth.

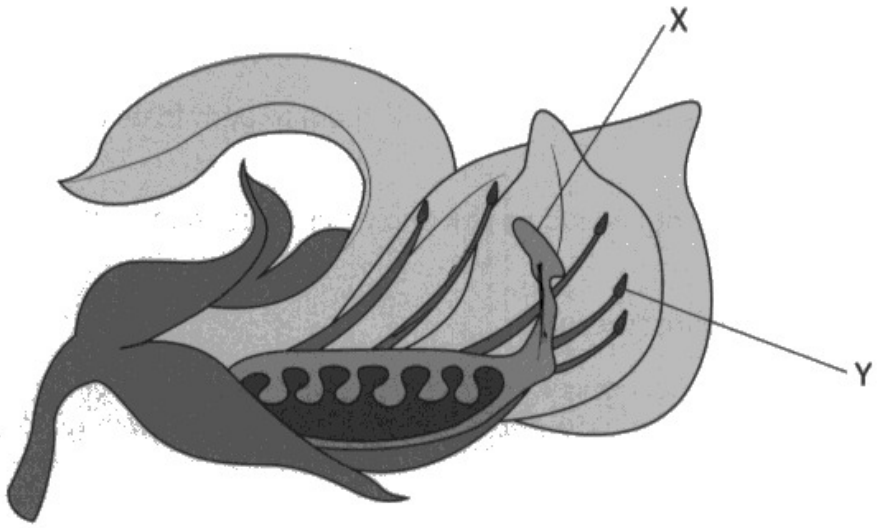
ResultsPlus
Examiner Comments

This answer gained no credit. No explanation has been offered other than both minerals are nutrients.

Question 9 (a)(i)

Most candidates were able to gain at least one mark by correctly labelling either the anther of the stigma. A number of candidates labelled the anther as the filament – candidates should take care that they are accurate with key terms.

9 (a) The diagram shows a pea flower with structures labelled X and Y.



(i) Give the names of structures X and Y.

(2)

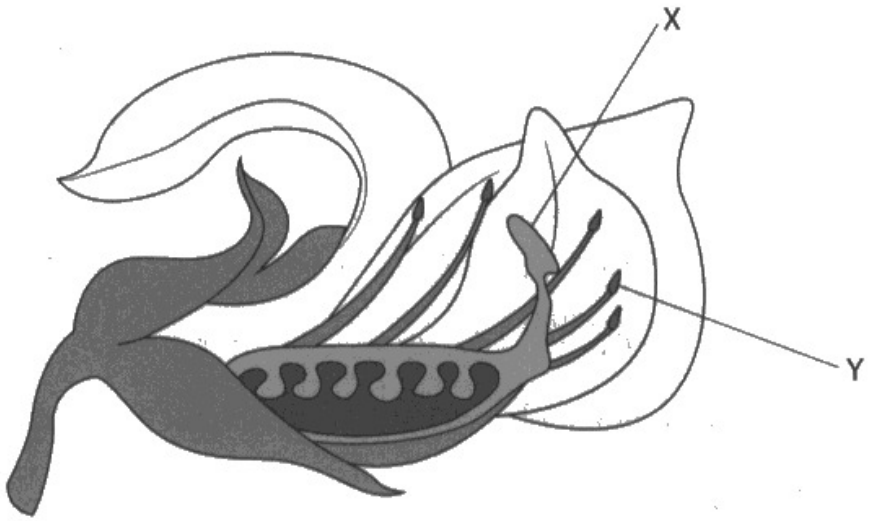
X Stigma

Y anther

ResultsPlus
Examiner Comments

This answer gained two marks as the candidate has correctly labelled each structure.

9 (a) The diagram shows a pea flower with structures labelled X and Y.



(i) Give the names of structures X and Y.

(2)

X stigma

Y filament

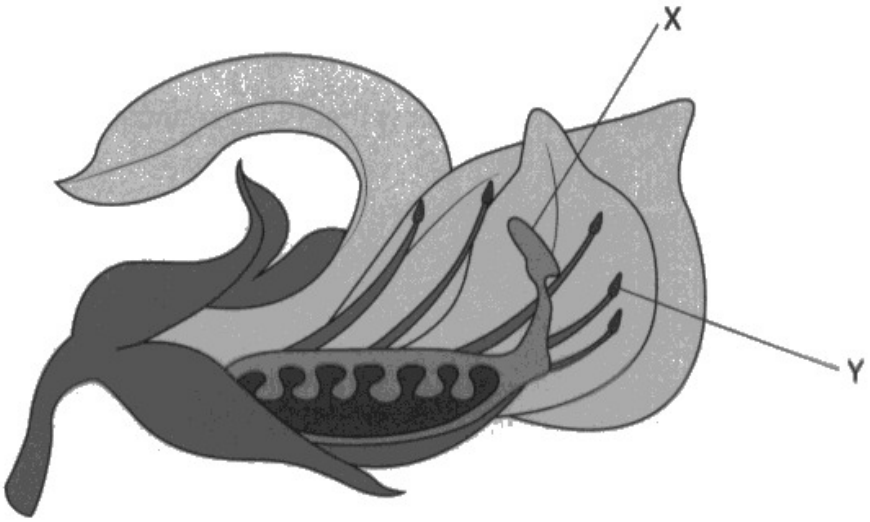
ResultsPlus
Examiner Comments

This answer gained one mark for correctly identifying the stigma. The anther was incorrectly labelled as the filament.

Question 9 (a)(ii)

Many candidates found this question challenging and either incorrectly stated that the flower was wind pollinated or simply stated that the flower could be either wind or insect pollinated. If asked to make a decision, candidates should not give two alternatives. Strong answers explained that the flower would be insect pollinated due to the large petals and enclosed anther and stigma. Some candidates correctly stated that the stigma was not feathery. A number of candidates misinterpreted the question and explained the events of fertilisation and fruit formation.

9 (a) The diagram shows a pea flower with structures labelled X and Y.



(i) Give the names of structures X and Y.

(2)

X Stigma

Y Anther

(ii) Explain how two structures, present in the diagram, show how the flower is pollinated.

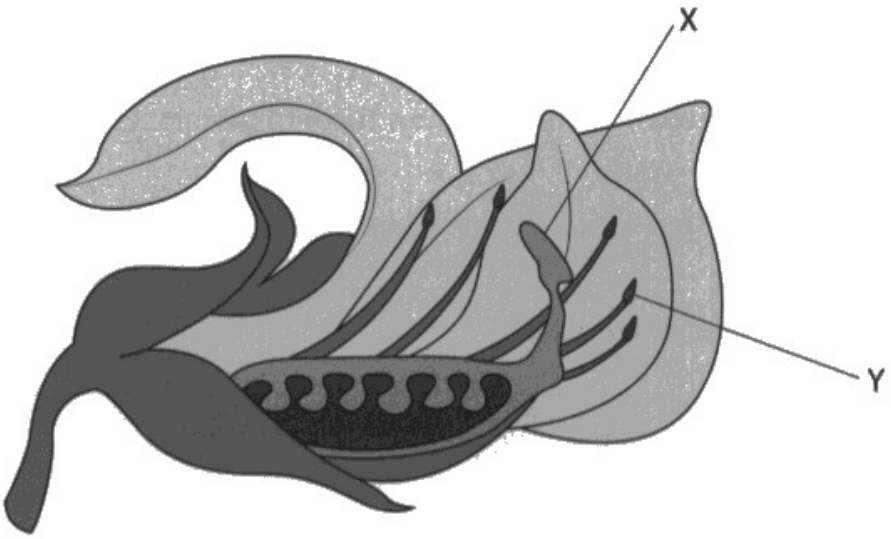
(3)

Because as the stigma is not long and feathery and not hanging outside of the plant and due to the anthers also not hanging outside of the plant, the flower is insect pollinated. The anther produces pollen (male gamete) which is transferred via fur of insect therefore the pollen will be transfered to the stigma for gamtisation to occur when pollen enters the ovary via the micropyle due to the fusion of male and female gametes.

ResultsPlus
Examiner Comments

This is an excellent answer that gained all three marks. The candidate clearly states that the flower is insect pollinated and goes on to state that the stigma is not feathery and the anthers are located within the flower.

9 (a) The diagram shows a pea flower with structures labelled X and Y.



(i) Give the names of structures X and Y.

(2)

X Stigma

Y anther

(ii) Explain how two structures, present in the diagram, show how the flower is pollinated.

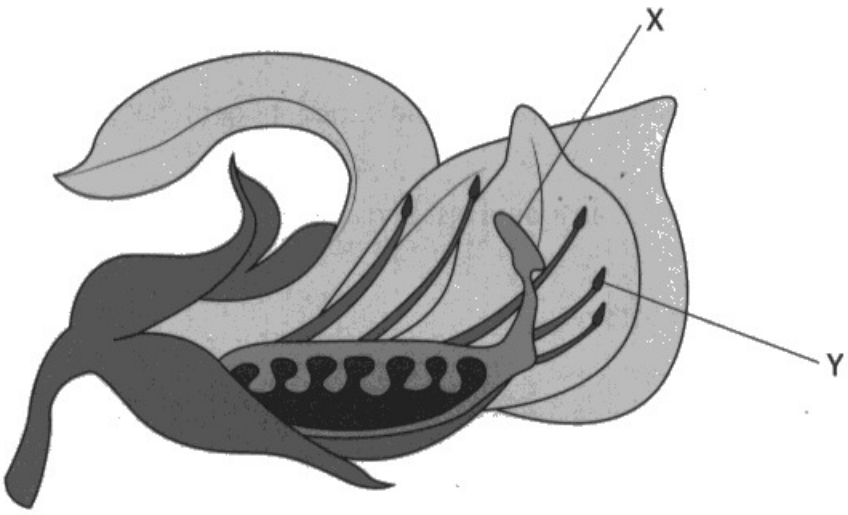
(3)

The large petles on the flower may suggest that it is insect polinated as the bugs are attracted to light colors. The flower also has nector at the base which will attract bugs to eat the nector in the flower and then fly away with the pollen grains stuck to the bug.

ResultsPlus
Examiner Comments

This answer gained two marks. The candidate has stated that the flower is insect pollinated and the petals are large.

9 (a) The diagram shows a pea flower with structures labelled X and Y.



(i) Give the names of structures X and Y.

(2)

X Stigma

Y Anther

(ii) Explain how two structures, present in the diagram, show how the flower is pollinated.

(3)

Firstly, the stigma (X) is not feathery and secondly the anthers are not hanging out or exposed. Therefore, this means that the flower is insect-pollinated.

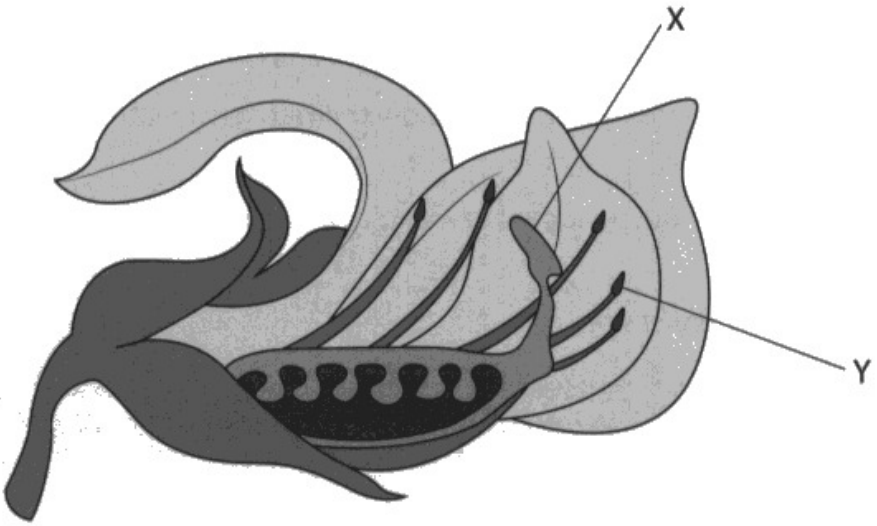
ResultsPlus
Examiner Comments

This good answer gained all three marks. It is a good example of how a precise answer can often gain all the marks without filling every line.

ResultsPlus
Examiner Tip

Do not feel that you always need to fill all the lines. Look at the number of marks allocated to a question to give you an idea of the number of points needed.

9 (a) The diagram shows a pea flower with structures labelled X and Y.



(i) Give the names of structures X and Y.

(2)

X Stigma

Y anthers

(ii) Explain how two structures, present in the diagram, show how the flower is pollinated.

Insect pollination;

(3)

The pollen is produced and stored in the anthers. Once an insect is attracted to the flower for food / scent / colour, the pollen sticks to the insect and is carried to another flower. The pollen is placed on the stigma of the second flower. The pollen grows a tube down the style into the ovary. The male gametes slide down into the ova and fertilise with the ovule.

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that the flower is insect pollinated. The rest of the answer is not relevant to the question.

Question 9 (b)(i)

This question was generally well answered with over half of candidates gaining at least one mark. Most recognised that starch was present in the ungerminated seed but fewer stated that starch and sugars would be present in the germinating seed. A number of candidates only referred to sugars in the germinating seeds.

(b) A scientist uses this method to compare the carbohydrates present in ungerminated and germinating pea seeds.

- carry out an iodine test and a Benedict's test on ungerminated seeds
- soak another set of seeds in water and allow them to germinate in unsealed jars
- after three days, carry out an iodine test and a Benedict's test on the germinating seeds

The table shows the scientist's results.

Seeds	Colour of iodine solution	Colour of Benedict's solution
ungerminated	black	blue
germinating	black	red

(i) State which carbohydrates the scientist identified in the ungerminated seeds and the germinating seeds.

(2)

ungerminated seeds

Starch

germinating seeds

~~Glycogen~~ Glucose

ResultsPlus
Examiner Comments

This answer gained one mark for correctly stating that starch is present in the ungerminated seeds. The candidate has incorrectly stated that the germinating seeds contain only glucose.

(b) A scientist uses this method to compare the carbohydrates present in ungerminated and germinating pea seeds.

- carry out an iodine test and a Benedict's test on ungerminated seeds
- soak another set of seeds in water and allow them to germinate in unsealed jars
- after three days, carry out an iodine test and a Benedict's test on the germinating seeds

The table shows the scientist's results.

Seeds	Colour of iodine solution	Colour of Benedict's solution
ungerminated	black	blue
germinating	black	red

(i) State which carbohydrates the scientist identified in the ungerminated seeds and the germinating seeds.

(2)

ungerminated seeds

starch

germinating seeds

starch and glucose

ResultsPlus
Examiner Comments

This answer gained both marks. The candidate correctly identifies the substances present in both germinating and ungerminated seeds.

(b) A scientist uses this method to compare the carbohydrates present in ungerminated and germinating pea seeds.

- carry out an iodine test and a Benedict's test on ungerminated seeds
- soak another set of seeds in water and allow them to germinate in unsealed jars
- after three days, carry out an iodine test and a Benedict's test on the germinating seeds

The table shows the scientist's results.

Seeds	Colour of iodine solution	Colour of Benedict's solution
ungerminated	black	blue
germinating	black	red

(i) State which carbohydrates the scientist identified in the ungerminated seeds and the germinating seeds.

(2)

ungerminated seeds

starch.

germinating seeds

~~the~~ glycogen

ResultsPlus
Examiner Comments

This answer gained one mark for correctly identifying starch in the ungerminated seeds. The candidate has incorrectly suggested that glycogen is present in the germinating seeds – candidates should be careful to understand the names of all biochemicals listed in the specification.

Question 9 (b)(ii)

This was a challenging question that many candidates found difficult. Stronger answers that gained full marks explained that in the germinating seeds, water would activate enzymes that digest the starch into maltose that is used in respiration. Many candidates appreciated that starch is a storage molecule in the ungerminated seeds and a few went on to explain that starch would not affect osmosis. Some candidates gave basic descriptions of the process of germination.

(ii) Explain the difference in the carbohydrate composition of the ungerminated seeds and the germinating seeds.

(3)

Since plants need glucose to grow, the presence of it in the germinating seed is explainable. Starch is present in both of them as its a product formed by every plant.

ResultsPlus
Examiner Comments

This answer gained no marks. The candidate has not given a function of the glucose – the statement that it is needed for germination is too vague.

(ii) Explain the difference in the carbohydrate composition of the ungerminated seeds and the germinating seeds.

(3)

'All carbohydrates in ungerminated seed is stored as starch in the endosperm. This is energy for the seed when it starts to germinate.

'In germinating seed, amaylse and maltase ~~breaks~~ digests starch store into glucose for respiration so both starch and glucose is present, but most starch is being turned into glucose.

ResultsPlus
Examiner Comments

This excellent answer gained full marks. The candidate explains that starch is used as a storage molecule and goes on to explain that it is digested by amylase (and maltase) in the germinating seed.

(ii) Explain the difference in the carbohydrate composition of the ungerminated seeds and the germinating seeds.

(3)

the carbohydrate in the ungerminated seed is starch as glucose is stored as starch so the composition of stored carbohydrate. While the germinated seed can do photosynthesis so the it has starch & glucose so the composition is stored and active.

ResultsPlus
Examiner Comments

This answer gained one mark. The candidate has correctly stated that starch is a storage molecule. They have then stated that the presence of glucose is due to photosynthesis which is incorrect.

Question 9 (b)(iii)

This question required candidates to explain the need for oxygen in respiration and germination. Most recognised that by leaving the tubes unsealed, air would be able to circulate. Many explained that oxygen would be able to enter for respiration and that waste carbon dioxide would escape. A number of candidates suggested that oxygen would enter for photosynthesis. Candidates should make sure that they do not confuse the processes of respiration and photosynthesis.

(iii) Explain why the jars used in the investigation are not sealed.

(2)

oxygen is needed for respiration, CO_2 is needed for photosynthesis. These processes are key to the plant germinating and thus the jars are unsealed so that the gases can go in and out

ResultsPlus
Examiner Comments

This answer gained both marks for the idea of oxygen being needed for respiration. The statement about the need for photosynthesis does not contradict the answer so was ignored.

(iii) Explain why the jars used in the investigation are not sealed.

(2)

So that air can travel in and out for aerobic respiration to take place.

ResultsPlus
Examiner Comments

This answer gained one mark. The candidate has correctly stated that respiration needs to occur but has not linked this to oxygen.

ResultsPlus
Examiner Tip

If aerobic respiration occurs, always refer to oxygen.

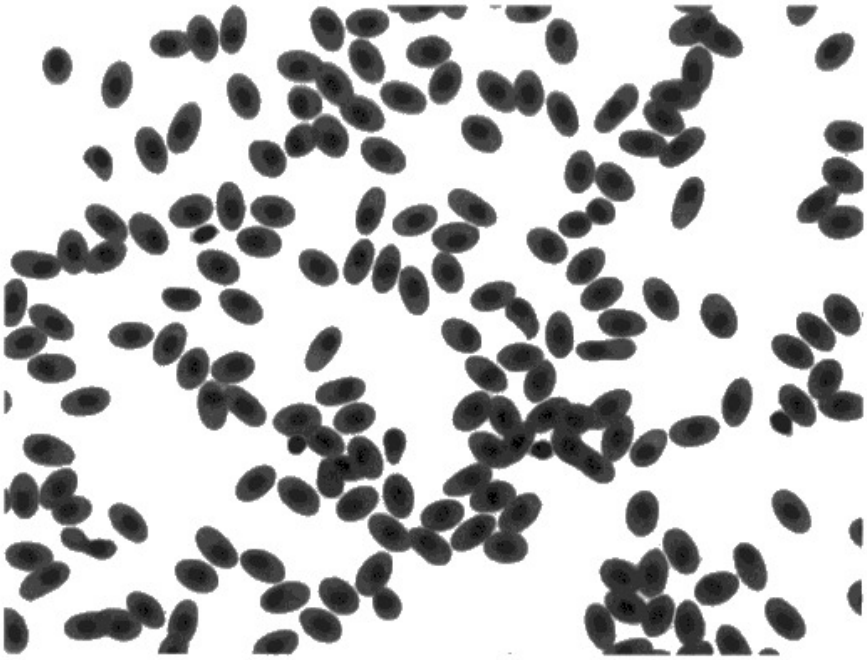
Question 10 (a)(i)

This question required candidates to examine the photograph of red blood cells from salmon and compare them with human red blood cells, stating a difference. Most recognised that the salmon cells contain a nucleus that is not present in human red blood cells. A few candidates did not read the instruction in the question to give a difference other than shape and referred to the biconcave shape of human red blood cells.

10 Red blood cells and white blood cells are two components of blood.

(a) The diagram shows some red blood cells from a fish.

Human red blood cells have a biconcave shape. Fish red blood cells have a more rounded, sphere-like shape.



(Source: © STEVE GSCHMEISSNER/SCIENCE PHOTO LIBRARY)

(i) Give a difference, other than shape, between the structure of fish red blood cells and human red blood cells.

(1)

They have a ~~nucleus~~ nucleus.

ResultsPlus
Examiner Comments

This answer gained one mark and is an example of a correct answer.

Question 10 (a)(ii)

Many candidates found this question challenging and did not give full depth and detail. Many simply re-stated the question stem, suggesting that the shape of the red blood cells meant that the transport of oxygen was less efficient. Strong answers that gained at least one mark explained that the presence of a nucleus reduced the space for haemoglobin and often went on to explain that the human cells have a higher surface area: volume ratio so that there is a more rapid diffusion of oxygen. Candidates should always try to use technical language such as surface area : volume ratio and diffusion in their answers.

(ii) Explain why fish red blood cells transport oxygen less efficiently than human red blood cells.

(2)

Because have more rounded the less surface area could carry the oxygen.

ResultsPlus
Examiner Comments

This answer gains one mark for stating that there is a reduced surface area. No further credit was awarded as there is no mention of diffusion or movement of oxygen in or out of the blood cells.

(ii) Explain why fish red blood cells transport oxygen less efficiently than human red blood cells.

(2)

Fish red blood cells transport oxygen less efficiently due to the smaller amount of surface area ~~on~~ they have compared to human red blood cells. This means less haemoglobin can carry less oxygen atoms.

ResultsPlus
Examiner Comments

This answer gained both marks. The candidate clearly states that there is a reduced surface area and goes on to explain that there is less haemoglobin in the cells.

(ii) Explain why fish red blood cells transport oxygen less efficiently than human red blood cells.

(2)

Having a nucleus reduces the area for haemoglobin to bind with oxygen and transport around the body. It also has a lower surface area than human red blood cells meaning diffusion is inefficient

ResultsPlus
Examiner Comments

This excellent answer gained both marks. The candidate clearly explains the reduced haemoglobin and reduced surface area.

Question 10 (b)

This question asked candidates to explain how the process of natural selection can explain the evolution of llamas to live at high altitude. Many candidates produced excellent answers that gained at least three marks with many going on to gain all four. Many candidates are now well prepared for evolution and natural selection questions. Most recognised that mutations would lead to the production of variation. Many also stated that some llamas would have a survival advantage so that they reproduce and pass on the allele. Some candidates simply reiterated the idea that some llamas would have a survival advantage but did not go on to explain this. Some candidates focused on the haemoglobin but did not refer to natural selection.

(b) Llamas are large mammals that have evolved to live at high altitude where there is less oxygen in the atmosphere.

The red blood cells of llamas can absorb more oxygen than the red blood cells of animals that live at low altitude.

Explain how llamas have evolved by natural selection to live at high altitude.

(4)

Some ~~the~~ llamas had a mutation which gave them a selective advantage. This variation in the genes led to only them surviving while the others without this variation either died or migrated. ~~this mutation was then~~ the llamas then reproduced and passed on this mutation onto their offspring. This was then repeated through the generations and helped them evolve.

ResultsPlus
Examiner Comments

This answer gained all four marks. The candidate clearly explains that mutation led to variation, a selective advantage, increased breeding and the passing on of the mutant allele.

(b) Llamas are large mammals that have evolved to live at high altitude where there is less oxygen in the atmosphere.

The red blood cells of llamas can absorb more oxygen than the red blood cells of animals that live at low altitude.

Explain how llamas have evolved by natural selection to live at high altitude.

(4)

llamas has ~~to~~ red bloods cells that absorb much more oxygen than human because of the habitat that they live in. So ~~to~~ that enabels them to survive and breath enough oxygen in ~~such~~ such low altitude. ~~Once~~ Once survival is present the llamas breed passing out the gene to the next ~~general~~ generations.

ResultsPlus
Examiner Comments

This answer gained three marks. The candidate explains that some llamas survive better, breed and pass the gene on to the next generation.

(b) Llamas are large mammals that have evolved to live at high altitude where there is less oxygen in the atmosphere.

The red blood cells of llamas can absorb more oxygen than the red blood cells of animals that live at low altitude.

Explain how llamas have evolved by natural selection to live at high altitude.

(4)

llamas with blood that can absorb more oxygen better survived as the air is thin and low O_2 concentration in mountains (selection pressure) this means llamas which are not suited for the environment die and cannot repriduce, but llamas which got the gene for blood with more O_2 absorbing capability by a random mutation survived and reproduced and passed on its gene so the offsprings can also have blood which can absorb more oxygen.

ResultsPlus
Examiner Comments

This excellent answer gained all four marks. The candidate explains how genetic mutations led to increased survival and breeding and that the gene is passed on to the offspring.

Question 10 (c)

This question assessed candidates' understanding of the role of phagocytes. Most were able to gain at least two marks. Many correctly described the process of ingestion of pathogens and their digestion by enzymes. A few candidates confused phagocytes with lymphocytes and referred to antibody production. Some candidates gave vague references to phagocytes destroying harmful substances rather than referring to digestion of pathogens. Candidates should always try to use technical terms in their answers.

(c) Phagocytes are white blood cells that are transported in the blood.

Describe the role of phagocytes in the body.

(3)

it detects bacterium
cells when it does it engulfs
the bacteria cell to prevent diseases

ResultsPlus
Examiner Comments

This answer gained two marks for the idea of ingesting bacteria.

(c) Phagocytes are white blood cells that are transported in the blood.

Describe the role of phagocytes in the body.

(3)

The phagocyte engulfs the pathogen by extending its nucleus and its cytoplasm then moves around the pathogen, creating a vacuole with the pathogen inside its membrane. Then, it secretes digestive enzymes to destroy the pathogen.

ResultsPlus
Examiner Comments

This excellent answer gained all three marks. The candidate correctly states that the phagocytes engulf pathogens and then digest them with enzymes.

(c) Phagocytes are white blood cells that are transported in the blood.

Describe the role of phagocytes in the body.

(3)

Phagocytosis is able to occur. Phagocytes can engulf bacteria (or other pathogens). Then it digests it and breaks it down. Afterwards it egests it out and bacteria dies.

ResultsPlus
Examiner Comments

This excellent answer also gains all three marks. The candidate clearly states that the phagocytes engulf pathogens and then digest them.

(c) Phagocytes are white blood cells that are transported in the blood.

Describe the role of phagocytes in the body.

(3)

Phagocytes detect a foreign pathogen and engulf it. They are non-specific and can destroy any pathogen. This prevents ~~disease~~ diseases.

ResultsPlus
Examiner Comments

This answer gained two marks for correctly stating that phagocytes engulf pathogens but does not mention enzymes or digestion.

Paper Summary

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

- ensure that they are familiar with all command words
- show all working for calculations
- practise analysis of data before the examinations
- select linear scales for graphs that have sensible increments
- use accurate, precise scientific vocabulary

Grade boundaries

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