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Examiners' Report June 2010

GCE Biology 6BI02

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Introduction

It was heartening to see many candidates demonstrating a good and clear grasp of the unit 2 specification, as illustrated by some thorough and considered answers being offered. Credit must go to the endeavour of candidates as well as to their teachers. In particular, candidates were exposed to some new How Science Works items such as question 1(a)(ii) and 8(a)(ii) and they tackled them effectively.

Some candidate responses would have benefitted from more precision as evidenced in question 8(a)(iii). It was not uncommon to see some answers being supplied that did not deal sufficiently with the question being asked. For example, in question 2(c)(i) a number of candidates wrote about whether stem cell research should be allowed or not rather than giving reasons for having an authority overseeing the use of stem cells.

Question 1(a) (i)

The majority of candidates offered two good answers. A variety of alternative words were used for marking point 2.

This response gained both marks.

(a) (i) Complete the following sentence by writing the most appropriate word or words on the dotted lines. (2)

In polygenic inheritance, the phenotypes are affected by forms of genes called alleles found at many points on chromosomes.



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Examiner Comments

This candidate response demonstrates one such alternative to loci. The term sites was another favourite, acceptable, alternative.



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Examiner Tip

Answers given the wrong way round could not be awarded.

Question 1(a) (ii) 1

It was pleasing to see that most candidates tackled this item with confidence, though this was dealt with less well than the mode.

Question 1(a) (ii) 2

It was most encouraging to see that the majority of candidates dealt with this item with ease.

Question 1(b) (i)

A majority of candidates were able to appreciate that this phenotype example was subject to both genetic and environmental aspects.

This response was awarded both marks.

(b) (i) Complete the following short passage by writing the most appropriate word or words on the dotted lines.

(2)

Animal fur colour is an example of a phenotype. The phenotype of an animal can be the result of an interaction between the

.....*environment*..... and the*genotype*.....

(iii) The answer to (iii) is:



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Examiner Comments

The order of candidate answers was not critical in this case.

Question 2(a)

Candidates explained the meaning of stem cell in a variety of different ways and all marking points were regularly seen.

This answer scores 1 mark

2 Stem cells are considered to be a potential treatment for many conditions. However, research on stem cells needs to be regulated.

*(a) Explain the meaning of the term **stem cell**.

A stem cell is a type of cell that has the potential⁽²⁾ to develop into all or most other types of cell. Stem cells are usually found during the development of a foetus, although adult stem cells are present in later life.



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Examiner Comments

The first sentence achieves marking point 2. However, the second sentence describes some of the potential sources.



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Examiner Tip

The phrase 'explain the meaning of the term' is one way of asking for a definition. Make sure that the definition given supplies, in this case, two facts to match the mark allocation.

Question 2(b)

Most candidates were able to offer at least two correct sources. A few candidates offered descriptions rather than stating the sources.

This responses was given marking points 2 and 4.

(b) State **three** potential sources of human stem cells.

(3)

1 embryo

2 bone marrow

3 blastocyst



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Examiner Comments

Answers 1 and 3 are essentially the same.

Question 2(c) (i)

Whilst some candidates clearly relished this question item and offered very detailed answers, a number described reasons for and against the use of the technique. It is vital that candidates target their responses accordingly.

This answer achieved both marks.

(c) (i) Suggest **two** reasons why there are regulating authorities for human embryo research. (2)

- 1 To prevent cloning. - make sure they follow ethical frameworks.
- 2 give guidelines on what can and can not be done.

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Examiner Comments

As the stem of the question refers to human embryos, it can be assumed that the candidate reference to cloning relates to humans. Marking points 2 and 5 are seen in this good response.

(c) (i) Suggest **two** reasons why there are regulating authorities for human embryo research. (2)

- 1 To discuss the ethical issues associated with the use of stem cells and make decisions.
- 2

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Examiner Comments

This is a good answer for marking point 2 as it clearly informs that the ethical issues of the use of embryos are being considered to make a decision.

Question 2(c) (ii)

Many candidates recognised the special understanding that scientists can bring to the regulating authority. However, candidates tended to be less secure on the role of people not involved in embryo research in the regulating authorities.

Two marks gained

- (ii) Suggest why these regulating authorities should include people involved in human embryo research and people not involved in embryo research.

(2)

People involved in embryo research will be able to fully explain the scientific benefits of using embryos & will be able to use these advantages to build a case for using embryos in research

People not involved in embryo research will be able to represent the views of those who may object to embryo research & present reasons against their use (such as religious objections) to ~~not~~ provide a balanced argument

(Total for Question 2 = 9 marks)



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Examiner Comments

This response illustrates the level of detail expected for 1 mark when describing the presence of people working in embryo research being on the regulating authorities.

The second answer gave details about alternative views and then a clear reference to a balanced argument at the end.

Question 3(a) (iii)

This item required candidates to apply knowledge from the question in a novel situation. About 40% gaining the mark.

Question 3(a) (iv)

This was a recall question requiring candidates to name a particular domain. Phonetic spellings were acceptable.

Mark not awarded

(iv) Give the name of **one** of the other two domains. (1)

An Prokaryotic.



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Examiner Comments

This was the most common incorrect answer seen.



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Examiner Tip

Make sure that all three domains are known and the significance of prokaryotes is appreciated.

Question 3(b) (i)

This item enabled a number of candidates to showcase their excellent knowledge and understanding of plant cell walls.

All 4 marks awarded for this good answer.

(b) One domain includes the plants and these have cells with a cell wall.

* (i) Describe the structure of a plant cell wall.

The cell wall of a plant is made up of long chains of cellulose, ^{polysaccharide} (4)
 β glucose joined together by glycosidic bonds. ~~The~~ Water molecule is removed and the ^{monosaccharides} ~~groups~~ are held together by oxygen. 50-80 chains of cellulose are held together by hydrogen bonds to form microfibrils. Microfibrils are strong threads of cellulose chains which provide support for the plant. Microfibrils are arranged in a net-like arrangement which further provides support for the plant which is the function of the cell wall.



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Examiner Comments

The thrust of the question is to the structure of the plant cell wall rather than to the structure of a cellulose molecule.



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Examiner Tip

As 4 marks are available, 4 different points should be offered by candidates.

3 marks supplied

(b) One domain includes the plants and these have cells with a cell wall.

* (i) Describe the structure of a plant cell wall.

(4)

- plant cell wall gives the plant stability.
- it is made up of microfibrils on a net like shape.
- ~~• it has a~~
- it has lignin in it increasing strength.
- made up of many layers.



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Examiner Comments

The first point is a general comment whilst the second one elicits marking points 2 and 5. The reference to lignin in the final bullet point is marking point 8.

Question 3(b) (ii)

The majority of candidates were able to name both features.

1 mark given

(ii) A student studied the cell wall arrangement between two adjacent plant cells. He noticed several features which he could not name. Two of these are described in the table below.

Complete the table by writing in the name of each feature described.

(2)

| Feature described | Name of feature |
|---|-----------------|
| Site where there was no cell wall and the cytoplasm linked the two adjacent cells | Pit |
| Dark line that is the boundary between one cell and the next cell | middle lamella. |



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Examiner Comments

This shows a common incorrect answer for the first feature described.

Question 4(a)

A number of candidates found this a challenging item with all combinations of alleles seen.

0 marks

Complete the diagram below to show the combination of alleles for the two recombinant chromosomes. (1)

The diagram shows two vertical chromosomes. The left chromosome has four segments labeled A, B, D, and e from top to bottom. The right chromosome has four segments labeled a, b, d, and E from top to bottom.

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Examiner Comments

This was perhaps the most commonly seen incorrect combination.

Question 4(b) (i)

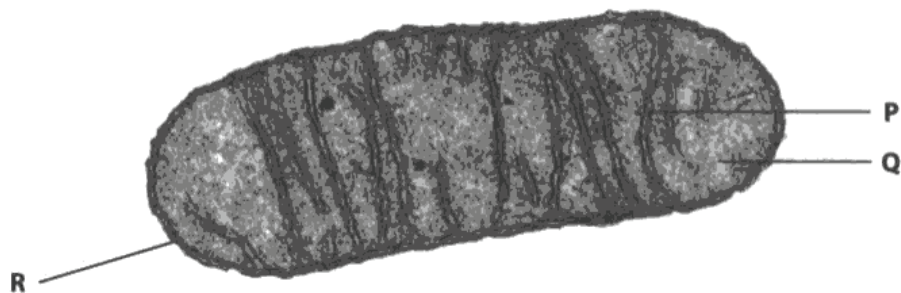
This item enabled a majority of candidates to demonstrate their ability to name the labelled structures.

Only label P gained the mark.

(b) Sperm cells are gametes. They contain mitochondria in their mid region.

(i) The photograph below shows a mitochondrion as seen using an electron microscope.

(3)



CNRI / Science Photo Library
Magnification x 90 000

Name the labelled structures shown in the photograph above.

P cristae.
 Q cytoplasm.
 R cell surface membrane.

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Examiner Comments

Whilst a mitochondrion is an organelle within the cytoplasm, it was not uncommon to see label Q being denoted cytoplasm. Likewise, the term cell surface membrane seems to be used commonly for any membrane by a number of candidates.

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Examiner Tip

It may be worth continuing to emphasize the the differences between envelopes, organelle membranes and cell surface membrane.

Whilst a mitochondrion is an organelle within the cytoplasm, it was not uncommon to see label Q being denoted cytoplasm.

Likewise, the term cell surface membrane seems to be used commonly for any membrane by a number of candidates. A good answer achieving all three marks

(b) Sperm cells are gametes. They contain mitochondria in their mid region.

(i) The photograph below shows a mitochondrion as seen using an electron microscope.

(3)



CNRI / Science Photo Library
Magnification x 90 000

Name the labelled structures shown in the photograph above.

P Cristae
Q matrix
R outer membrane



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Examiner Comments

All three answers are clear.

Question 4(b) (ii)

It is pleasing to read so many full answers to this high scoring item.

This is a detailed answer that achieves all 3 marks.

(ii) Explain the function of mitochondria in sperm cells.

(3)

Mitochondria are found in the mid region of the sperm cell and provide the flagellum with energy, in the form of ATP. This energy ensures that the sperm cell can get to the egg cell. Mitochondria are the site for aerobic respiration, and so are found in areas such as the mid region of sperm, which require lots of energy.



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Examiner Comments

There was no requirement to give details of the position of the mitochondria as this question focuses on the function.

Question 4(c) (i)

This calculation posed few problems for the majority of candidates.

Two marks awarded.

(c) In some species of mammal, at fertilisation most of the sperm cell enters the egg cell. The fertilised cell then divides by mitosis.

- (i) A sperm cell containing 65 mitochondria fertilises an egg cell containing 100 000 mitochondria. Calculate the percentage of the total mitochondria in this fertilised cell that come from the sperm cell. Show your working. (2)

$$65 \div 100065 = \frac{6.5}{100065} \times 10^{-4} \times 100 = 0.065\%$$



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Examiner Comments

The calculation is clear and easy to follow

Question 4(c) (ii)

Approximately 60% of candidates successfully supplied the answer to this item. A commonly seen technique, used by candidates, to gain the answer of 16 is illustrated in the example below.

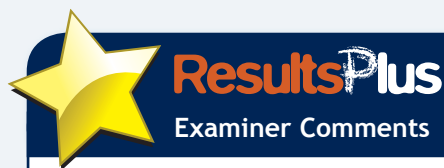
Mark achieved.

(ii) State how many cells there would be after the fertilised egg has divided, by mitosis, **four** times. (1)

$x/6 =$

16.

(Total for Question 4 = 10 marks)



The branching diagram enables the answer to be gained

Question 5(a) (i)

It is expected that candidates should recognise that starch is composed of alpha glucose rather than just glucose. However, only a minority supplied the correct answer.

Question 5(a) (ii)

This item required candidates to link two structural points to functions for starch. Whilst there were some excellent answers demonstrating detailed understanding of these two interrelated concepts, a number of general responses were seen.

Two marks scored.

*(ii) Describe **two** ways in which the structure of starch is related to its function. (4)

Structure

Has ~~a~~ glycosidic bonds

Function

allows hydrolysis to take place and split the glucose into sub units which are more useful.

Structure

Compact structure

Function

allows it to store a lot of



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Examiner Comments

No marks for the first structure and function answer. Second one is a good example of mp5 and 6.



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Examiner Tip

When a question asks for structure and function it is likely that the items must link to each other.

This is a most encouraging and detailed answer that fully deserves its 4 marks.

* (ii) Describe **two** ways in which the structure of starch is related to its function. (4)

Structure amylose long unbranched chains, coil structure

Function This enables a tight coil structure so it can be compacted this is a beneficial feature as a energy source, as it can store alot of energy in a small space

Structure amylopectin long branched chains

Function These branched chains allow enzymes to reach the glycosidic bonds which join the alpha glucose together. This enable a rapid glucose release so energy can be accessed quickly



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Examiner Comments

Good answer with all marks awarded.

Question 5(b) (i)

This item asked candidates to describe the temperature effect for all three varieties. It was not uncommon for candidates to describe only one or two varieties.

1 mark awarded

- (i) Describe the effect of temperature on the mean percentage of amylose in the rice grains of all three varieties of rice plant.

(2)

The higher the temperature, the lower the mean percentage of amylose - negative correlation, e.g. for variety A at 23°C, the percentage was 19.5% but for 31°C it was just 15.5% showing that temperature does have an effect

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Examiner Comments

This first two lines give a general description so is awarded marking point 1. The rest of the response repeats the data rather than manipulating it.

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Examiner Tip

It is usual to have a marking point for correctly manipulating data when numerical information is supplied.

2 marks awarded

- (i) Describe the effect of temperature on the mean percentage of amylose in the rice grains of all three varieties of rice plant.

(2)

For all types of rice plant, the mean % of amylose present was higher at 23°C than at 31°C. The largest difference in mean % was in variety C, ~~at~~ going from 20% at 23°C to 15% at 31°C which is a difference of 5%.

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Examiner Comments

The first sentence is an alternative way of expressing marking point 1.
The second mark is awarded for correctly manipulating the data

Question 5(b) (ii)

This item elicited the full mark range, though most candidates were able to at least correctly suggest rice variety B.

This candidate achieved 3 marks. To gain all 3 marks a correct reference has to be made to the spread of data,

- (ii) Using the information in the graph, suggest which set of data is least supportive of the statement that 'temperature has an effect on the percentage of amylose present in rice grains'. Explain your answer.

(3)

The data for variety B supports this statement the most because it shows that from an increase in temperature of 8°C the mean percentage of amylose in a rice grain only ~~changed~~ ^{decreased} by 1.5%, which is less than the decrease for the other varieties of rice plant. The graph also shows that at 31°C the range of ~~percentage~~ percentage of amylose in rice grains of variety B was from 15.5% to ~~just under 17.4%~~ ^{about} 17.4%, while the percentage of amylose present at 23°C ranges from ~~15.6%~~ ^{17.1%} to 18.6%. These ~~two~~ ranges overlap, showing that for variety B the temperature did not have much effect on the percentage of amylose present in a rice grain.

(Total for Question 5 = 10 marks)



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Examiner Comments

Towards the end of this response the candidate both identifies marking points 4 and 5.



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Examiner Tip

Take note of the presence of error bars as it is likely that a question will relate to them.

1 mark achieved by this candidate

- (ii) Using the information in the graph, suggest which set of data is least supportive of the statement that 'temperature has an effect on the percentage of amylose present in rice grains'. Explain your answer.

(3)

Variety B is least supportive of this statement as the percentage of amylose in a rice grain at 23°C and 31°C are very similar. At 23°C there is less than ^{1.5%} ~~1.5%~~ more amylose than ~~is~~ at ~~30~~ 31°C. This is such a small difference that no real conclusion can be drawn. The results could simply be representative of this particular grain or the researcher could have misread the measurements. A larger greater difference would be needed to support the statement - (Total for Question 5 = 10 marks)



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Examiner Comments

The question refers to least supportive, so a comparison to the other varieties is expected.

Question 6(a)

This was the first time that niche has been tested and candidates generally tackled it admirably. One of the examples below gives the most commonly seen definition.

Species richness was thoroughly understood by the majority of candidates.

No marks awarded

6 Biodiversity, including both species richness and genetic diversity, is an important concept to be considered when organising captive breeding programmes.

(a) Explain what is meant by each of the following terms.

(3)

Niche A group of organisms that are very similar, as close

Species richness The amount of variation in a species.



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Examiner Comments

This species richness comment was the most commonly seen incorrect one



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Examiner Tip

Know your definitions

All 3 marks awarded.

6 Biodiversity, including both species richness and genetic diversity, is an important concept to be considered when organising captive breeding programmes.

(a) Explain what is meant by each of the following terms.

(3)

Niche is the way a species exploits its environment. How it uses it for food, shelter etc

Species richness - is the different amount of different species found in a habitat at a given time.



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Examiner Comments

The niche definition offered here was the most widely seen. The reference to amount of species was an acceptable alternative to a number of species.

Question 6(b) (i)

Many candidates were able to link the information in the table to the potential risk to cheetah survival. However, it was not uncommon to see confusion between genes and alleles.

All three marks given.

* (i) Using the information in the table above and your own knowledge, suggest why the cheetah is the cat at most risk if the environment changes.

(3)

The cheetah has the lowest amount of different alleles for different genes, this means that if there were environmental changes because it does not have many different alleles, it may not have the allele which is most adapted to the new environment, therefore being more at risk to death and extinction, because it cannot adapt to its new environment, due to having the lowest genetic diversity.

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Examiner Comments

The first sentence correctly acknowledges that the question is asking why the cheetah is most at risk.

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Examiner Tip

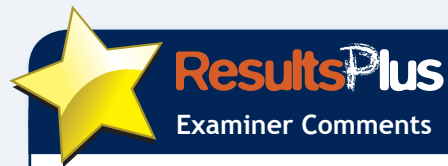
Make sure the difference between a gene and an allele is clear.

This candidate's response was worth 1 mark

- * (i) Using the information in the table above and your own knowledge, suggest why the cheetah is the cat at most risk if the environment changes.

(3)

Cheetah has the lowest percentage of different alleles in their genes, which means they are more exposed to dangers of a change in the environment. They have the smallest gene pool and so are not highly protected. Inbreeding might take place.



This answer gained marking point 1 at the start and again at the end. However, the remainder was rather general.

Question 6(b) (ii)

This item enabled candidates to either tackle the question from the genetic diversity approach (marking points 1 and 2) or from a reproductive point of view (marking points 3 and 4).

Marking point 1 awarded.

Suggest why this may be advantageous to cheetahs.

(2)

This would allow the offspring to have different variations, and this will increase the genetic diversity.



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Examiner Comments

The reference to different variations would not elicit the mark but different alleles would have done. However, the final statement achieves the first marking point.

A good answer for two marks.

Suggest why this may be advantageous to cheetahs.

(2)

The female cheetah is mating with a variety of partners so genetic variation is increased within the cheetah population. It increases the variety of alleles so cheetahs are less likely to become extinct if there is an environmental change. The two or three cubs will all grow to reproduce and therefore increasing the cheetah population.



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Examiner Comments

The reference to genetic variation is increased would be marking point 1.

Question 6(c)

The role of inter zoo swapping was well known by a majority of candidates and most gained both marks. Again the use of genes and alleles interchangeably limited the marks of some.

Two marks awarded.

Suggest what effect transferring Rafa from one zoo to another had on genetic diversity in this species.

(2)

Increased genetic diversity ~~and~~ due to
~~the~~ ^{passing on,} everytime ~~going~~ / most probably different
alleles and so increase genetic diversity.
and transferring to him to different zoos decreases
the chances of inbreeding.



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Examiner Comments

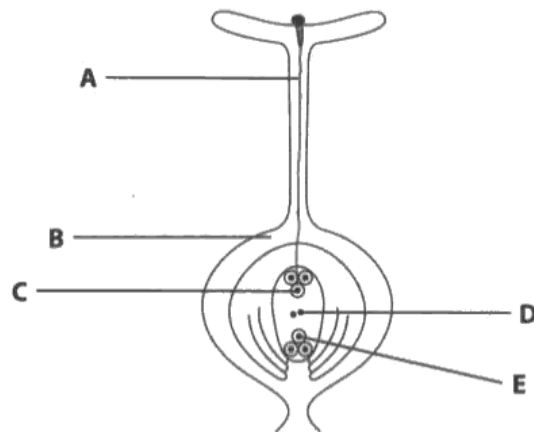
Both marking points 1 and 3 supplied.

Question 7(a) (i)

Most candidates were able to correctly show the route taken by a pollen tube but the two most common errors shown are illustrated in the examples below.

1 mark awarded.

(a) The diagram below shows a pollen grain on the stigma of a flower.



- (i) On the diagram above, draw a line to show the route taken by the pollen tube, from the pollen grain to the micropyle.

(2)



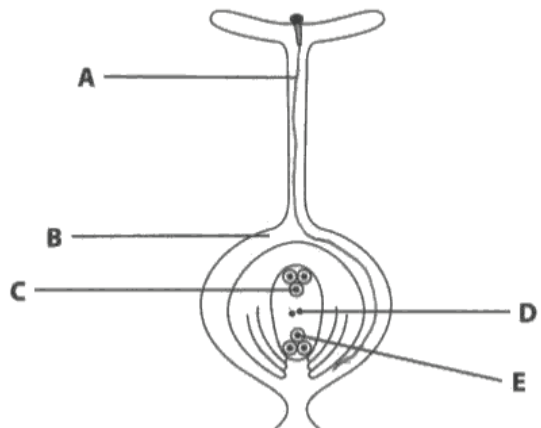
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Examiner Comments

Marking point 2 not given.

1 mark awarded.

(a) The diagram below shows a pollen grain on the stigma of a flower.



(i) On the diagram above, draw a line to show the route taken by the pollen tube, from the pollen grain to the micropyle.

(2)

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 Examiner Comments
 Marking point 1 only awarded.

Question 7(a) (ii)

This item was generally tackled well with only a minority offering more than two answers.

Question 7(b) (i)

This question required candidates to compare the pollen tube growth with and without boron present. The whole mark range was seen and some answers were rather ambiguous.

1 mark given.

Time / hours

- (i) Using the information in the graph, compare the mean pollen tube length in these two sugar solutions, over this 30-hour period.

(3)

The mean pollen tube length when the sugar solution contained boron is ^{much} higher across the 30 hours than the solution without boron. This proves that this element helps the pollen tubes grow bigger.



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Examiner Comments

Marking point 2 is awarded here.

This response gains all three marks.

Though both the lengths of the pollen tubes increase over the 30 hours the pollen tube growing in the sugar solution with boron increased a lot more, to more than double that of the tube growing without boron. The gradient is much steeper for the tube with boron solution showing it grew faster. However the tube growing without boron grew more consistently as the line is straighter.



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Examiner Comments

The first sentence covers marking points 1 and 2. However, 'more than double' is not marking point 3 (but 180 micrometres difference after 30 hours would have been). The description at the end stating 'grow faster' is marking point 3.

Question 7(b) (ii)

Few candidates had difficulty extracting the information from the graph to correctly tackle this question item. The example below is a typical correct response.

Mark awarded.

(ii) Using the result of this investigation, a student concluded that boron was necessary for pollen tube growth. Suggest why another student disagreed with this conclusion. (1)

Because even ^{the pollen tube in} the solution without boron grew to approximately 120µm



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Examiner Comments

A clear description stating that growth occurs without boron present.

Question 7(b) (iii)

Rather similar to (b)(ii) in that most candidates gave a precise statement to elicit the mark.

Question 7(b) (iv)

This required candidates to apply knowledge in an unfamiliar situation and most achieved 1 or 2 marks. The two most commonly awarded marks are shown in the example below.

Both marks awarded.

(iv) Suggest the advantages to flowering plants of increased pollen tube growth. (2)

If the rate of growth is faster ~~the~~ then fertilisation will occur more swiftly.
The pollen tube will be more likely to reach the embryo sac.



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Examiner Comments

A correct reference is made to marking point 3 in the secondly line. In the final sentence, more likely to reach the embryo sac is an alternative for marking point 1.

Question 8(a) (i)

Candidates generally had little trouble in recognising the relationship between nitrate concentration and mitosis. However, it was more rare to see a correct manipulation of the data.

Two marks given for this good answer.

- (ii) Using the result of this investigation, a student concluded that boron was necessary for pollen tube growth. Suggest why another student disagreed with this conclusion. (1)

Because even the ^{pollen tube in} ~~the~~ solution without boron grew to approximately 120µm.

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Examiner Comments

This response shows two different manipulations of the data, namely 24% and 6 cells.

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Examiner Tip

Remember that a describe question with data is likely to have a mark for correctly manipulating the data.

Question 8(a) (ii)

It was encouraging to see many candidate answers demonstrating a good grasp of How Science Works, as tested in this question item.

Both marks awarded.

- (ii) Suggest why a prediction of the number of cells undergoing mitosis, if the nitrate ion concentration used were 9.9 mmol dm^{-3} , would be unreliable.

(2)

Only ~~two~~ results from two different concentrations of nitrate ion have been carried out, not enough to form a pattern that could be used to predict future results. Also a prediction can never be very reliable as there could be a drastic change at 9.9 mmol dm^{-3} , experiments need to be carried out to ensure reliability.



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Examiner Comments

Initially marking point 1 is supplied by the candidate. They then correctly make reference to not enough data to form a pattern which is marking point 2. They then describe how the pattern may change.

Question 8(b)

It was pleasing to see candidates having a good appreciation of this core practical. Many recognised the need for controlling variables, having 3 or more different nitrate concentrations as well as detailing how the growth of the root would be assessed.

This answer achieves 3 marks.

(b) Describe an experiment to find the optimum nitrate ion concentration for the growth of wheat seedling roots. (3)

I would prepare at least five ^{mineral solutions} nutrient broths containing five different concentrations of nitrate ions, including one with no nitrate ions^{as a control}; then I would measure the number of cells undergoing mitosis per 500 cells & length of the seedling roots and plot them on a graph. I would use the same plant species throughout the experiment and I would ^{try to keep} control the room temperature, sunlight and other variables constant. I would then repeat the experiment several times to take an average to have reliable results.

(Total for Question 8 = 10 marks)



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Examiner Comments

A clear answer

Many candidates offered excellent responses to a host of question items testing different aspects of unit 2, from factual detail, through data interpretation and applying knowledge, to How Science Works. A number, unnecessarily, tended to repeat the question as the beginning of their answer but this is not necessary and could reduce a candidates time, and therefore, opportunities, to deliver the mark scoring components of their responses.

Grade Boundaries

| Grade | Max. Mark | A | B | C | D | E | N |
|-----------------------|-----------|----|----|----|----|----|----|
| Raw boundary mark | 80 | 59 | 54 | 49 | 45 | 41 | 37 |
| Uniform boundary mark | 120 | 96 | 84 | 72 | 60 | 48 | 36 |

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