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Examiners' Report January 2011

GCE Biology 6BI02 01

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Introduction

This paper offered a range of opportunities for candidates to demonstrate their knowledge of unit 2 and to apply factual material in a number of novel situations. Many showcased excellent understanding and credit should go to both the candidates and their teachers.

Whilst interpretation of data, both in graphical and in table form, continues to offer challenges for some, it was encouraging to see more candidates tackling this component with precision and accuracy, hence scoring the marks available. Those aspects of How Science Works tested were generally handled competently by the majority of candidates. However, for many, the terms gene and allele tended to be used interchangeably which sometimes cost candidates marks.

Question 1 (b)

This fact-based item suggested candidates had a good appreciation of the subject matter. A few appeared to confuse totipotent with pluripotent whilst a minority left some of the answer cells blank.

Question 1 (c)

It was pleasing to encounter many thorough and carefully considered candidate responses to this question item. Answers were usually logically and sequentially delivered though a few went into considerable detail on one aspect at the expense of offering the 'full story' from stem cell in the bone marrow to differentiated blood cell.

A detailed answer that achieved full marks. In fact, the candidate supplied all marking points except marking point 3.

*(c) Human bone marrow contains stem cells that can give rise to various types of blood cell including white blood cells.
Suggest how a stem cell in the bone marrow can become a differentiated blood cell.

(4)

- correct stimulus is given ie chemical stimulus
- some genes are active ; other genes are inactive
- only active genes produce mRNA
- mRNA travels to the ribosome and read out
- correct protein is then produced
- this protein can permanently modify the cell
∴ therefore is now differentiated / specialised

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Examiner Comments

Whilst marking point 3 was not included in this response, the sequence remained logical and so satisfied this aspect of QWC.

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Examiner Tip

When a question item would benefit from an answer given in a sequential manner, it is good practice to do so as this is likely to elicit more detail from the candidate with greater opportunities to access the higher marks.

Question 2 (a)

This question set out the compare parameters of one similarity and two differences between modern drug testing protocols and William Withering's approach, for candidates. This allowed many to display a most encouraging grasp of this element of topic 4.

This answer displays the most frequently offered correct series of responses.

2 Many drugs used in medicine are developed from plants. These drugs have to be tested before they are used.

(a) In 1775, William Withering published details of testing digitalis soup on patients with dropsy.

Compare this historic drug testing with contemporary drug testing protocols.

Give **one** similarity and **two** differences, other than the use of a **placebo**, between these two protocols.

(3)

Similarity In both protocols, the drugs are tested on patients

Difference 1 In the ^{the} contemporary protocol, a double-blind trial is used.

Difference 2 In ^{the} contemporary protocol the drug is tested on animals before it is given to humans.



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Examiner Comments

If, for difference 1, the reference to contemporary protocol was not present, it would not be clear whether the candidate felt that a double-blind trial only occurred in contemporary drug testing protocols or was carried out by William Withering. The mark may not be awarded.



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Examiner Tip

Whenever a compare question is tackled, make sure that that the answer considers both similarities and differences.

Question 2 (b) (i)

The majority of candidates recognised that the placebo would contain 0 mg of the drug. However, about 25% erroneously extrapolated back the concentration sequence to offer 200 mg as an answer.

Question 2 (b) (ii)

It was pleasing to read many clear answers that offered sensible suggestions for the recorded improvement in the condition for those taking the placebo.

Question 2 (b) (iii)

Most candidates appreciated the need to remove the recorded improvement in treatment one from the remaining treatments.

Question 2 (b) (iv)

This item delivered the full range of marks and reflects the need to be able to analyse numerical data.

This candidate response, and the majority of answers, correctly made reference to the relationship between drug concentration and actual improvement. Marking point 1 only was awarded.

	/ mg	/ arbitrary units
2	400	6
3	600	12.1
4	800	12.5

- (iv) Use the information in this table to describe the relationship between the concentration of the drug used and the actual improvement in people with schizophrenia.

The higher the concentration of drug, the higher the actual improvement. However if the concentration passes the optimal it will decrease. (2)
 At 600mg concentration it was 12.1 actual improvement but when 800mg concentration it didn't improve much. From 12.1 - 12.5.



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Examiner Comments

Like many, this candidate repeated the data already presented in the table, rather than manipulating it.



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Examiner Tip

Often finding the difference, through a subtraction, between the first and last set of data would satisfy the 'credit correct manipulation of the data' marking point. In this case it would be: a 6.5 arbitrary unit improvement as the drug concentration increased from 400 mg to 600 mg.

Question 3 (a)

This question item allowed a number of candidates to display a detailed and accurate grasp of these two aspects of biodiversity. Most candidates appeared to have a most encouraging appreciation of the meaning of species richness but some were less secure with regard to genetic diversity.

The candidate in this response has elected to offer one difference for both aspects of biodiversity and then move onto the next difference. This approach is most commendable but was rarely seen. The majority of candidates wrote about genetic diversity and then species richness or *vice versa*.

3 There are now over 1400 seedbanks in the world and they store plant seeds to maintain genetic diversity. Plant seeds are carefully selected and processed so they can be stored for years in a seedbank.

(a) Give **two** differences between genetic diversity and species richness.

(2)

1 Genetic diversity takes into account the variation of different alleles, whereas species richness doesn't.

2 Species richness tells you about the number of different species in an area, but genetic diversity doesn't.



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Examiners' Comments

Only marking point 2 was awarded. No reference was made to genetic diversity being within a single species to complement the comment made about species richness.

Question 3 (b)

Most candidates demonstrated a pleasing appreciation of the aspects covered about seed storage in seedbanks.

Many candidates offered clear and full answers to part (i). Many correctly described marking point 1 for (b) (ii) but it was rare to see either of the other two marking points.

(b) (i) Suggest **two** reasons why it is better to store seeds rather than to store whole plants.

(2)

1 It is better to store seeds because they are much smaller than whole plants, so you can fit more seeds into an available space, than you would be able to do with whole plants.

2 plants produce a large number of seeds, so collecting ~~these~~^{some} seeds for seed banks is unlikely to negatively effect the number in the wild population, whereas using whole plants would affect the number in the wild.

- (ii) Suggest why it is better to store seeds from several individual plants of one species rather than seeds from one individual plant.

(2)

It is better to store plants from several plants, because it would mean that there would be more genetic diversity in the seed sample collected, and for example it would decrease the chances that if they just took samples from one plant, these seeds could have a mutation that makes them unable to survive in the wild, therefore using seeds from a range of individuals increases their chance of survival if they have to be reintroduced into the wild.



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Examiner Comments

This candidate correctly makes reference to the ability to store more seeds (marking point 2) in (b) (i). However, the phrase 'in the available space' does not necessarily imply that less space is needed, therefore the first marking point would not be awarded. For part (b) (ii), this example does offer an acceptable alternative for marking point three.



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Examiner Tip

Make sure that the differences between gene pool and genotype are appreciated.

Question 3 (c) (i)

An encouraging majority of candidates dealt effectively with this calculation.

Question 3 (c) (ii)

Few candidates had difficulty in judging that species B was the correct answer. Whilst a variety of reasons were offered, many did not take note of the importance of the emboldened word.

This response was typical of many seen. Marking point one was achieved at the start of the answer. Data in the table was then repeated without manipulation.

(ii) Using the data in the table, suggest which of the four species is **least** likely to survive storage in a seedbank. Give reasons for your answer.

(3)

Encholirium species B is least likely to survive storage in a seed bank because te- out of the 50 seed plants replanted after being air-dried only 23 were able to germinate. Also even when planted immediately, only 40 of 50 seeds for ~~the~~ Encholirium B survived.



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Examiner Comments

It was common practice to see candidates stating Species B and then, unnecessarily, repeating the stem of the question, as in this answer.



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Examiner Tip

Manipulating numerical data is regularly a better option than repeating the data.

Question 3 (c) (iii)

The extensive list supplied in the mark scheme enabled most candidates to score well in this question item. However, it was rare to see marking point two.

Drying and low temperatures were the preferred choices for candidates.

(iii) Suggest how seeds from these *Encholirium* species may need to be treated to ensure their long term survival in a seedbank.

(2)

The seed will have to be stored
away from sunlight, also the
seed must not be planted again
also unless the seed is to be germinated



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Examiner Comments

This response, however, displays one of the other two popular treatments (marking point six). The fourth being marking point two.

Question 4 (a)

Many candidates had a very decent understanding of the importance of meiosis and all marking points were regularly seen in candidate responses.

This answer generally illustrates a good descriptive response, eliciting three marks. However, there is some ambiguity present.

4 Meiosis is involved in the formation of human gametes.

(a) Explain the importance of meiosis in the formation of human sperm and egg cells.

(3)

In meiosis the end cells all have half the number of chromosomes, 23 in humans, and the end cells are all genetically different from each other by the chromatids crossing over. This is important as when the sperm & egg combine they will have the right number of chromosomes and it will be genetically different to the father & the mother.



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Examiner Comments

The first two lines warrant marking point one whilst the third line makes it clear that there are genetic differences within the gametes formed. This is marking point three.

The chromatid reference is sufficiently clear to award marking point five but what structure has the 'right number of chromosomes', especially as the phrase is prefixed 'they'? This implies more than one structure is being considered.

Question 4 (b) (ii)

This item proved a challenging one for a number of candidates. The two examples offered identify typical responses encountered.

The candidate has a thorough understanding of this early stage of the acrosome reaction.

(ii) Describe how the acrosin is released from the acrosome.

(2)

exocytosis, vesicle containing the acrosin fuses with the cell surface membrane. when it ~~en~~ tries to penetrate the zona pellucida.



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Examiner Comments

Whilst there is no reference to the cell surface membrane being that of the sperm, the comment about the zona helps to put it in the correct context. Marking points five, three and four are given in this response.

This type of answer was regularly seen, where the sperm bursts and the whole acrosome is released. It gains no marks.

(ii) Describe how the acrosin is released from the acrosome.

(2)

The mitochondria releases energy that causes the head of the sperm cell to burst open. This releases acrosome which secretes the enzyme acrosin that digests the zona pellucida of egg cell.



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Examiner Comments

At the end of this answer, the candidate has started to write about the function of acrosin, whilst the question only required details of acrosin release.



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Examiner Tip

It is always important to make sure the answer given carefully matches the gist of the question.

Question 4 (c) (i)

Most candidates successfully interpreted the data to enable them to deliver answers worthy of credit. A minority assumed that activity was synonymous with concentration.

This response achieved the mark.

(i) A student stated that acrosin needs to be active for the eggs to be fertilised and that the higher the acrosin activity, the greater the percentage of eggs fertilised.

Give **one** piece of evidence from the table that supports some of his statement.

(1)

At 2.5 arbitrary units^(au) only 33% of eggs were fertilised but at 5.0 au 100% were fertilised - proving the higher the acrosin activity the greater % fertilised.



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Examiner Comments

The candidate initially repeats some of the data presented in the paper but then, at the end, produces a description that would be awarded the mark.

Question 4 (c) (ii)

This proved a rather tricky item for a sizeable minority of candidates and the response shown was typical.

No marks awarded for this example.

(ii) Using the data in the table, suggest why the student could **not** support all of his statement.

(1)

Due to 5 arbitrary units of Acrosin providing 100% of fertilised eggs, any increase in Acrosin past 5 will not make any effect on percentage of eggs fertilised.



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Examiner Comments

The candidate has tried to extrapolate beyond an acrosin activity of 5.0 arbitrary units when the focus was at the other end of the scale.

Question 5 (a)

Whilst all three marking points were seen, most candidates gave responses that covered either marking point one or two and were rewarded with one mark.

This candidate has offered two reasons to support the idea that organs can be considered more complex than tissues.

5 Plants are multicellular organisms that contain organic molecules such as starch and cellulose.

(a) Multicellular organisms contain organs and tissues.

Suggest why organs are considered more complex than tissues.

(2)

organs are a group of tissues working together to perform a particular function. They are larger and contain even more cells ~~than~~ than just tissues.



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Examiner Comments

The phrase 'a group of tissues' clearly implies more than one tissue type so marking point one was awarded. However, the statement about even more cells is not necessarily equivalent to more cell types, hence marking point two not given.



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Examiner Tip

It was sensible to offer two reasons here for two marks. However, make sure that the answers are unambiguous.

Question 5 (b) (i)

Many candidates gave excellent answers to this item. Indeed, it was not uncommon to come across responses that covered every marking point.

Likewise, spelling of the technical words was encouraging. Only amylopectin proved a stumbling block for some.

Whilst this example illustrates a good factual answer, its scope goes beyond that which was necessary to score the marks. Essentially the question requested structural details but functional aspects were also offered.

* (b) (i) Compare the structure of a cellulose molecule with the structure of starch. (4)

Starch is ~~is~~ long chains of α glucose used for storage because in one form, Amylose, it coils because of the angles of the 1,4 glycosidic bonds, and in its other form, Amylopectin, it is branched for easy break down and release of energy. Cellulose is made of long chains of β -glucose but is not coiled or branched but is in a long, straight chains.



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Examiner Comments

The marking points awarded are five, six, four and one. Therefore, whilst a glucose is mentioned early on and it is not until later in the paragraph that β glucose is mentioned, this is okay. The candidate's latter statement allowed both marking points four and one to be awarded.

Question 5 (b) (ii)

Candidates generally made the transition from cellulose molecule in the last question item to cellulose microfibrils in this one, so were able to access both marks.

This description of the arrangement was the most common one offered but all the alternatives found on the mark scheme were encountered.

The reference to strong is an alternative to marking point one so both marks awarded here.

(ii) Cellulose molecules form cellulose microfibrils.
Explain how the arrangement of cellulose microfibrils contributes to the physical properties of plant fibres.

(2)

Form a net like arrangement
making plant fibres strong



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Examiner Comments

As the stem of the question refers to microfibrils we can assume that this is what the candidate is referring to in their response.

Question 5 (c) (i)

Whilst all areas were offered as locations for xylem vessels, the majority correctly identified the inner most area of one, or more, vascular bundles.

Question 5 (c) (ii)

Most candidates were able to offer two good functions of xylem vessels. The majority of those that did not achieve both marks tended to give rather too general answers such as structure unqualified.

This candidate gained both marks.

(ii) Give **two** functions of xylem vessels. (2)

- 1 To transport water and mineral ions
- 2 To support plants structure.



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Examiner Comments

Both marks achieved in the first line. The candidate then offered the third major function on the next line.

Question 6 (a)

The majority of candidates supplied growth or a suitable alternative such as cell replacement for marking point one but then reaffirmed the point rather than offering a different role for the second mark.

Question 6 (c)

Generally candidates displayed a most pleasing knowledge base of metaphase and anaphase. Good descriptions were common but the item remained a challenging one as it required candidates to identify comparative differences from two named phases.

This is a very comprehensive answer gaining all three marks.

(c) A student prepared a root tip squash to observe the stages in mitosis. Describe how the student could distinguish between a cell in metaphase and a cell in anaphase.

(3)

A cell in metaphase would involve the chromosomes lining up on the metaphase plate in a condensed state. They would appear as 2 chromatids. Anaphase involves the splitting of the chromatids + so the centromere holding the chromatids together would also split. The spindle fibres move the chromatids to opposite ends of the cell as the spindle fibres contract. In metaphase there would be 4 chromosomes, in anaphase there would be 8 chromatids.

(poles, centromere first, centromere first)

(Total for Question 6 = 7 marks)

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Examiner Comments

The reference at the bottom to a stated number of chromosomes was not uncommon and probably comes from the number seen in diagrams in lessons or / and textbooks. Such references did not interfere with the awarding of marks.

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Examiner Tip

Make sure that there is no confusion between chromosomes and chromatids, and also between centrioles and centromeres.

Question 7 (a) (i)

The responses given by candidates suggested that the majority had suitably encountered this core practical in their studies.

Many candidates were able to offer three good and sensible factors that needed to remain constant.

(a) The student carried out the investigation four times to achieve reliable results.

(i) Suggest **three** factors that would need to be kept constant in this investigation.

(3)

- 1 Diameter of fibre.
- 2 Fibre used from the same plants.
- 3 ~~amount of area~~ length of fibres.



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Examiner Comments

This candidate achieved all three marks by giving answers covering marking points two, four and one.

Question 7 (a) (ii)

The majority had little difficulty in giving answers that achieved both marks. However, there were two notable exceptions and an example of each is illustrated here.

The stem of the question refers to four sets of data for reliability so if a reference is made to division by a number, it should be four.

(ii) Describe how the results obtained would be processed to produce a mean. (2)

The experiment would be repeated several times and the mean result [excluding ~~obvious~~ outliers] would be calculated by adding them all together and dividing by no. of tries. e.g. $5+7+8 = \square \rightarrow \square \div 3 = \square$ Answer.

**ResultsPlus****Examiner Comments**

This candidate has chosen to describe a theoretical calculation using a different number of data sets to that described. As their description is correct for the summation, marking point one is awarded, but not marking point two.

**ResultsPlus****Examiner Tip**

Always check the detail given in a question.
Make sure of the definitions and differences between reliability and validity.

This example did not gain the award of any marks.

(ii) Describe how the results obtained would be processed to produce a mean. (2)

The amount of weights needed to break the fibre each time are recorded. The results are then used to produce a mean.

**ResultsPlus****Examiner Comments**

This response focused on the collection of data and recording rather than the processing, which was the aspect being tested in this question item.

Question 7 (b)

Candidates generally found this How Science Works question on accuracy challenging.

The response given here was typical of the majority seen.

(b) Suggest why increasing the mass by 50 grams each time, rather than 100 grams, could increase the accuracy of the student's results. (1)

Will help you know the exact mass the



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Examiner Comments

The answer suggests that a reduction in the mass added to the fibre each time would identify the exact mass required to break the fibre. Consequently, it did not gain the mark.

Question 7 (c)

This item delivered a rather bimodal set of responses. On the one hand, candidates took note of the important word 'safety' and scored the mark, whilst on the other hand, candidates ignored this word and wrote about weights hitting the bench, etc.

Question 7 (d) (i)

Almost all candidates gained this mark. However, it was very pleasing to see a good number correctly making reference to outlier.

Question 7 (d) (ii)

A number of candidates clearly relished this item and wrote good, clear and interesting responses that sometimes included their own views. However, ambiguity did limit some candidates answers. Most notable is the comment that the actual oil-based plastic fibres are non renewable and take millions of years to form rather than the oil itself.

The response offered here gains both marks as marking points one and two.

(ii) Suggest why the use of oil-based plastic fibres such as nylon, rather than plant fibres, does not contribute to sustainability.

(2)

Oil-based plastic fibres come from fossil fuels (oil), which ~~is~~ ^{are} not renewable, as they will one day run out. Therefore oil-based fibres will not meet the needs of the next generation. Where as plant fibres are sustainable, as you are not using fossil fuels and plant fibres can be regrown



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Examiner Comments

The first part of this answer is a clear description of the first marking point.

The second part makes an initial reference to plant fibres being sustainable. This is essentially a reaffirmation of the stem of the question, a common phenomenon of candidate answers. However, the candidate then refers to regrowing for the second marking point.

Question 8 (a)

This item was handled well by the majority of candidates though some found it difficult to express themselves sufficiently clearly with regard to marking point one.

This response, like many, focused on marking points two and three. It gained both marks.

8 Various internal and external factors can affect the phenotype of humans.

(a) Explain what is meant by the term **phenotype**.

(2)

the phenotype shows the effect of the genotype and the environment on an organism, ~~what affects the organism.~~



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Examiner Comments

A short and clear answer

Question 8 (b) (i)

Candidates tended to divide up into those that correctly considered the absence of smoking as the control and those that viewed having a relative with or without cancer as the control. In both cases, many recognised the function of the control.

An example that scored both marks.

(i) Identify the control group in this survey and suggest why they were included.

(2)

The people that didn't smoke, so that the number of lung cancer cases in the control could be compared to the people that do smoke.



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Examiner Comments

A clearly expressed and succinct response.



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Examiner Tip

The function of the control is usually to allow a comparison to be made. In this case it is to be able to compare between the situation without smoking with smoking at various levels.

Question 8 (b) (ii)

Candidates generally displayed the necessary understanding of phenotype in the context of this question item.

Question 8 (b) (iii)

As with other numerical data interpretation, a number of candidates found this item challenging. It was rare to find answers that covered more than marking point one.

This achieves the first marking point which considers the overall trend. However, it then, as was often the case, repeats some of the data rather than looking for trends within the data or / and manipulating the data.

(iii) Describe the effect of smoking on the increased risk of developing lung cancer, for the people who had close relatives who developed cancer.

(2)

The data shows that as the number of ~~cigar~~ packs smoked a year increases, so does risk of developing cancer. e.g. those who smoked 21-40 ~~we~~ had a risk of 6 units where as those who smoked 61+ were at 14 units



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Examiner Comments

The figures quoted in this response are not correct.



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Examiner Tip

Care is required when reading data off a graph.

Question 8 (b) (iv)

Candidates generally found this a challenging item and few offered both marking points one and two.

This answer achieved marking point one only.

(iv) Use evidence from the graph to support the suggestion that genetic factors may influence the risk of developing lung cancer. (2)

From 21-40 packs of cigarettes and onwards, those who had cancer in at least one ~~one~~ close relative had a higher chance of developing cancer than those who didn't. This indicates that ~~some~~ ~~if you~~ share the same genes as someone who has cancer you are more likely to get it.



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Examiner Comments

The reason for this candidate not being awarded marking point three is that all humans share the same genes.



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Examiner Tip

Make sure the difference between genes and alleles is thoroughly appreciated.

This candidate has attempted to offer all three marking points. They would certainly be awarded marking point one early on and marking point two at the end.

(iv) Use evidence from the graph to support the suggestion that genetic factors may influence the risk of developing lung cancer. ^{relative with cancer.}
(2)

The graph shows that if more than 20 packets of cigarettes are smoked a year, you are more likely to develop lung cancer if you have a relative with cancer, than if you don't have a relative with cancer. This shows how ~~the~~ cancer can be influenced by genetics. If no cigarettes are smoked, you still have a chance of developing lung cancer if you've had a close relative with cancer.



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Examiner Comments

Marking point three would not be given as the reference to genetics is very general. There is, for example, no link to close family members being more genetically similar.

Question 8 (b) (v)

This item also proved discriminative with just over half achieving the mark.

Question 8 (b) (vi)

This final item was generally handled well by candidates.

This wide-ranging paper, both in terms of content coverage and skills required, produced a good spread of marks and allowed the candidates many opportunities to demonstrate their knowledge and understanding.

Question items requiring extended responses such as Q1 (c) and Q5 (b) (i) were dealt with logically and well by many candidates. Likewise, the majority of candidates were able to effectively apply knowledge to unfamiliar situations as illustrated by Q2 (b).

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