A Level Biology A (Salters-Nuffield)

EXEMPLAR WORK WITH COMMENTARIES

Pearson Edexcel Level 3 Advanced GCE in Biology A
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About this booklet

This booklet has been produced to support biology teachers delivering the new GCE A level Biology A specification (first assessment summer 2017).

The booklet looks at questions from the Sample Assessment Materials. It shows real student responses to these questions, and how the examining team follow the mark schemes to demonstrate how the students would be awarded marks on these questions.

How to use this booklet

Our examining team have selected student responses to 4 questions from the trialling of the Sample Assessment Materials. Following each question you will find the mark scheme for that question and then a range of student responses with accompanying examiner comments on how the mark scheme has been applied and the marks awarded, and on common errors for this sort of question.
A central idea in biology is that DNA codes for the synthesis of proteins from amino acids. The instructions for making proteins are in the form of mRNA.

The diagram shows two stages in the production of mRNA.

(a) Explain how this molecule of mRNA is produced.

(b) Sometimes the process is more complicated as shown in the diagram below.

An initial estimate of the number of genes, based on the number of proteins found in humans, was in the region of 100 000. It is now known that the number of genes is around 25 000.

Explain how the formation of mRNA, shown in the diagram, might account for this.
## Mark scheme

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Acceptable Answer</th>
<th>Additional guidance</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>9(a)</td>
<td>An explanation that makes reference to four of the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DNA unzips and one strand acts as a template (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• ribonucleotides pair up with complementary bases (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• RNA polymerase joins ribonucleotides together to form pre-mRNA (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• the mRNA has fewer bases than pre-mRNA / gene (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• as a result of removal of introns / mRNA made up of exons only (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>9(b)</td>
<td>An explanation that makes reference to the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• It was assumed that one gene makes one protein (so there should be 100 000 genes but there are 25 000 genes) (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• the diagram shows that one gene can make more than one mRNA (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• one gene can code for several proteins (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• due to removal of different exons (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• reference to post-transcriptional change (1)</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>
Student answers for part a)

Student answer A

(a) Explain how this molecule of mRNA is produced.

Examiner comments
Answers need to give details of what happens at each step in the diagram. Details of splicing need to be given; therefore this response only gains Mp5 for the removal of the introns.

Mark awarded = 1

Student answer B

(a) Explain how this molecule of mRNA is produced.

Examiner comments
This response gains Mp1 as 'opened up' is just equivalent to unzips and 'template' is mentioned on line 3. Mp5 is awarded for the reference to introns being removed on line 5. Mp2 cannot be awarded as there is no reference to complementary bases.

Mark awarded = 2
Student answer C

(a) Explain how this molecule of mRNA is produced.

The DNA is unzipped and nucleotides line up on the template strand. RNA polymerase joins the nucleotides together to produce the pre-mRNA. This molecule is a complementary copy of all the introns and exons in the gene.

Then nucleases remove the bases in the introns and the exons are spliced together. This produces the mRNA by post-transcriptional modification.

Examiner comments
This response contains good detail of what happens at each stage and can be awarded Mps1, 2, 3 and 5.
Mark awarded = 4
Student answers for part b)

Student answer A

Explain how the formation of mRNA, shown in the diagram, might account for this.

As you can see, alternative splicing in which some of the genes are missed out in transcription, this leads to a larger number of gene sequences. As shown above, the same gene can code for more than one strand of mRNA, which has a different sequence which will lead to the translation of a different protein depending on which genes are expressed. So a single gene can produce different proteins and order, more than one mRNA, leading to more protein than.

Examiner comments

Mp2 can be awarded but the response is not clear enough for Mp1 and the reference to genes being expressed is too confused for Mp3.
Mark awarded = 1

Student answer B

Explain how the formation of mRNA, shown in the diagram, might account for this.

The diagram shows how 1 gene can code for more than one mRNA and therefore more than one protein can be translated from a single gene.

So there will be fewer genes than proteins.

Examiner comments

Mp2 and Mp3 are clearly stated.
Mark awarded = 2
Student answer C

Explain how the formation of mRNA, shown in the diagram, might account for this.

5 marks

The early idea that one gene codes for one polypeptide meant that about 100,000 genes would be needed. The human genome project has shown that the number of genes we need is fewer. That’s because one gene can code for more than one polypeptide.

The diagram shows that two different mRNAs can be produced, if not only the introns are removed but some of the exons as well. One mRNA has 3 exons missing and the other has 4 exons removed. There could be another mRNA with no exons removed. They would all be translated into different polypeptides. (Total for Question 9 = 9 marks)

Examiner comments
This response can be awarded Mps 1, 2, 3 and 4 as the reference to polypeptide is equivalent to protein. There is no reference to the term post-transcriptional change.
Mark awarded = 4
Exemplar question 2

10 A student investigated the light-dependent reactions of photosynthesis in spinach leaves.

The leaves were cut into pieces and ground in a cold solution of sucrose and a buffer.

The mixture was filtered and centrifuged. The liquid in the tube was poured off and kept in an ice water bath.

The pellet at the bottom of the tube was suspended by mixing with fresh sucrose and buffer and stored in an ice water bath.

Four tubes were then set up as follows:

<table>
<thead>
<tr>
<th>Tube</th>
<th>Liquid poured off after centrifuging / cm³</th>
<th>Resuspended pellet / cm³</th>
<th>Sucrose and buffer solution / cm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–</td>
<td>0.5</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>–</td>
<td>–</td>
<td>0.5</td>
</tr>
<tr>
<td>3</td>
<td>–</td>
<td>0.5</td>
<td>–</td>
</tr>
<tr>
<td>4</td>
<td>0.5</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

The tubes had 5 cm³ of DCPIP added to them. Tube 3 was kept in the dark and the others kept in the light.

After twenty minutes, the colour in each tube was recorded. The results are shown in the table below.

<table>
<thead>
<tr>
<th>Tube</th>
<th>Colour in tube</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pale green</td>
</tr>
<tr>
<td>2</td>
<td>blue</td>
</tr>
<tr>
<td>3</td>
<td>blue</td>
</tr>
<tr>
<td>4</td>
<td>blue</td>
</tr>
</tbody>
</table>

(a) (i) Give two reasons why a cold solution containing sucrose and a buffer was used in this investigation.

(2)
(ii) Give a reason why tube 3 was used in this investigation.

(iii) In another investigation, the student wanted to determine the effect of different wavelengths of light on the light-dependent stage of photosynthesis.

The student modified her first investigation to obtain results.

The graph shows the results of her modified investigation.

Explain how the student modified the practical procedure of the first investigation to enable these results to be obtained.
## Mark scheme

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Acceptable Answer</th>
<th>Additional guidance</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>10(a)(i)</td>
<td>An answer that makes reference to the following:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• {cold / buffered} to stop enzyme denaturation (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• sucrose to stop osmotic loss of water from chloroplasts (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10(a)(ii)</td>
<td>• tube 3 is a control to show DCPIP does not change colour over time (1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Student answers for part a) i)

Student answer A

(a) (i) Give two reasons why a cold solution containing sucrose and a buffer was used in this investigation.

(2)

Sucrose -- keep water potential constant
Buffer -- keep pH levels constant; they will change slowly

Examiner comments
This response needs to be qualified with reference to the consequences for the chloroplasts and enzymes in order to gain Mp1 and Mp2.
Mark awarded = 0

Student answer B

(a) (i) Give two reasons why a cold solution containing sucrose and a buffer was used in this investigation.

(2)

Cold solution so no enzymes will denature.

Examiner comments
This response refers to the cold solution only and the consequence for enzymes, so Mp1 can be awarded.
Mark awarded = 1
**Student answer C**

(a) (i) Give two reasons why a cold solution containing sucrose and a buffer was used in this investigation.

1. It needs to be used to stop denaturation of enzymes.
2. A sucrose solution is needed to stop the chloroplast from breaking changing shape due to osmosis.

**Examiner comments**
This response has a clear reference to both the conditions in the question and they are correctly qualified.
Mark awarded = 2

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**Student answers for part a) ii)**

**Student answer A**

(ii) Give a reason why tube 3 was used in this investigation.

To ensure results were actually due to light’s presence.

**Examiner comments**
This is a vague response with no reference to control and the effect on DCPIP.
Mark awarded = 0

**Student answer B**

(ii) Give a reason why tube 3 was used in this investigation.

As a control.

**Examiner comments**
To be worthy of a mark the response requires both a reference to control and the effect on DCPIP.
Mark awarded = 0
Student answer C

(ii) Give a reason why tube 3 was used in this investigation.

Tube 3 is a control to check that SP1P does not change on its own.

Examiner comments
This response has a clear reference to the control and why it is needed.
Mark awarded = 1
Exemplar question 1

8 Movement at a joint is brought about by the contraction of antagonistic muscles which contain slow and fast twitch fibres.

The diagram shows a knee joint.
(b) Explain why muscles occur in antagonistic pairs. 

(c) A group of scientists investigated the effect of aging on the Ca-ATPase activity in fast and slow twitch muscle fibres obtained from rats. The results are shown in the graph.

![Graph showing ATPase activity over age]  

The membranes in these fibres contain the enzyme Ca-ATPase which is involved in the transport of calcium ions.

The scientists concluded that in older muscle it takes longer to restore the calcium ion balance.

Analyse the data to evaluate whether these results support the scientists' conclusion.
**Markscheme**

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Acceptable Answer</th>
<th>Additional Guidance</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>8(b)</td>
<td>An explanation that makes reference to:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• muscles can only work in one direction (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Plus one from:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• therefore a need to create opposite forces (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• so must have extensors and flexors (1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Question Number</td>
<td>Indicative content</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8(c)</td>
<td>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Supports • this is true after 10 months because there is a significant decrease for the slow twitch • if muscle is {mainly slow twitch / has fewer fast twitch} • Ca-ATPase will take longer to transport calcium ions into the sarcoplasmic reticulum Does not support • ageing has {no / little} effect on fast twitch fibres • there is little difference between the fast and slow twitch up to 10 months • appropriate comment on the difference between the data related to the variation as shown by the error bars</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level</th>
<th>Mark</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>No awardable content</td>
</tr>
<tr>
<td><strong>Level 1</strong></td>
<td>1-2</td>
<td>Limited scientific judgement made with a focus on one side of the argument only. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.</td>
</tr>
<tr>
<td><strong>Level 2</strong></td>
<td>3-4</td>
<td>A scientific judgement is made through the application of relevant evidence to both sides of the argument. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.</td>
</tr>
<tr>
<td>Level 3</td>
<td>5-6</td>
<td>A scientific judgement is made, which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.</td>
</tr>
</tbody>
</table>
Student answers for part b)

Student answer A
(b) Explain why muscles occur in antagonistic pairs.

Examiner comments
This response is poorly expressed but just acceptable for Mp1. There is a reference to flexor and extensor muscles for Mp2.
Mark awarded = 2

Student answer B
(b) Explain why muscles occur in antagonistic pairs.

Examiner comments
Rather poorly expressed but just acceptable for Mp1.
Mark awarded = 1

Student answer C
(b) Explain why muscles occur in antagonistic pairs.

Examiner comments
There is no creditworthy content in this response.
Mark awarded = 0
Student answers for part b)

Student answer A

Analyse the data to evaluate whether these results support this conclusion.

The conclusion is not fully supported by these results. It is supported by the results shown by the slow twitch fibres. The activity of ATPase greatly reduces after a peak at the age of 10 months, falling from 1.04 au to 0.82 au in a space of 18 months. In contrast to this, the amount of ATPase activity in fast twitch fibres drops 0.04 au from a peak at 10 months.

Examiner comments

This response has a very good opening sentence but it goes on to make only limited reference to both sides of the argument with little supporting evidence. This is sufficient for level 2. However, the argument is not sustained so level 3 is not reached.

Mark awarded = 3
**Student answer B**

Analyse the data to evaluate whether these results support this conclusion.

Both fast twitch and slow twitch go up from 5-10 months. Then they both decrease as the months go on. However, the slow twitch muscles decrease at a more negative gradient than the fast twitch and continues to decrease. The fast twitch decreases a smaller amount than slow twitch and only from 10-16 months. Then it stays constant. As slow twitch decreases uniformly, and more than fast twitch, the conclusion is supported by this graph.

**Examiner comments**

The majority of this response describes the trends or restates the data. There is one judgement made about the conclusion in the last sentence. However, the reference to the graph is too vague to be accepted as supporting evidence and therefore this is worthy of level 1 only. The other side of the argument supported by more precise evidence from the data would be required to raise this response to level 2.

Mark awarded = 1
The membranes in these fibres contain the enzyme Ca-ATPase which is involved in the transport of calcium ions.

The scientists concluded that in older muscle it takes longer to restore the calcium ion balance.

Analyse the data to evaluate whether these results support the scientists' conclusion.

The data doesn't support the conclusion because the activity increases and the error bars from 5 to 10 months in both types of fibre. There's no data on the ratio of the two fibres changing. So it doesn't support as there could be fewer slow fibres as it ages. The data does support the statement because although the activity in fact is constant from 16 to 28 months it decreases by 0.04a. So with less enzyme activity the calcium ion balance will take longer.

**Examiner comments**

This response makes several references to clearly expressed, evidence from the data that supports and does not support the conclusion. Some statements are outside the indicative content but are still creditworthy in the context of the data e.g. reference to number of fibres changing with age. There is sustained reference to the data in the graph which is analysed e.g. error bars. This is clearly worthy of level 3 and a mark of at least 5 is appropriate.

Mark awarded = 5
Exemplar question 1

5 There have been several studies into the relationship between cigarette smoking and deaths from lung cancer. The data in the table comes from a review of these studies.

<table>
<thead>
<tr>
<th>Country</th>
<th>Size of study</th>
<th>Number of deaths from lung cancer</th>
<th>Ratio of smokers to non-smokers dying from lung cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>34000 males</td>
<td>441</td>
<td>14.00</td>
</tr>
<tr>
<td></td>
<td>6194 females</td>
<td>27</td>
<td>5.00</td>
</tr>
<tr>
<td>Sweden</td>
<td>27000 males</td>
<td>55</td>
<td>7.00</td>
</tr>
<tr>
<td></td>
<td>28000 females</td>
<td>8</td>
<td>4.50</td>
</tr>
<tr>
<td>Japan</td>
<td>122000 males</td>
<td>940</td>
<td>3.76</td>
</tr>
<tr>
<td></td>
<td>143000 females</td>
<td>304</td>
<td>2.03</td>
</tr>
<tr>
<td>Canada</td>
<td>78000 males</td>
<td>331</td>
<td>14.20</td>
</tr>
<tr>
<td>USA</td>
<td>358000 males</td>
<td>2018</td>
<td>8.53</td>
</tr>
<tr>
<td></td>
<td>483000 females</td>
<td>439</td>
<td>3.58</td>
</tr>
<tr>
<td>USA</td>
<td>290000 males</td>
<td>3126</td>
<td>11.28</td>
</tr>
<tr>
<td>USA</td>
<td>188000 males</td>
<td>448</td>
<td>10.73</td>
</tr>
<tr>
<td>USA</td>
<td>68000 males</td>
<td>368</td>
<td>7.61</td>
</tr>
</tbody>
</table>

(a) Give two reasons why the ratios of smokers to non-smokers who die from lung cancer are different for males compared with females.  

(b) These studies suggest that there is a correlation between smoking and lung cancer. State what is meant by correlation.  

*(d) Cancer is the result of the abnormal growth of cells in an organ. These cells develop into a tumour which does not carry out the function of the tissues in the organ.

An article states:

“Tobacco smoke is the cause of kidney cancer!”

Evaluate the claim that tobacco smoke is the primary cause of kidney cancer.
### Markscheme

<table>
<thead>
<tr>
<th>Question Number</th>
<th>Acceptable Answer</th>
<th>Additional guidance</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>5(a)</td>
<td>An answer that makes reference to two of the following:&lt;br&gt;• because females smoke fewer cigarettes / inhale less (1)&lt;br&gt;• because females smoke different lower tar cigarettes (1)&lt;br&gt;• because smoke for fewer years / started smoking later (1)</td>
<td></td>
<td>(2)</td>
</tr>
<tr>
<td>5(b)</td>
<td>Correlation shows an association or relationship but no causal link (1)</td>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Question Number</td>
<td>Indicative content</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 5(d)            | Answers will be credited according to candidates’ deployment of knowledge and understanding of material in relation to the qualities and skills outlined in the generic mark scheme.  

The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.  

Candidates are expected to reach a decision/judgment on whether tobacco smoke is the primary cause of kidney cancer.  

• Idea that tobacco smoke is a risk factor for kidney cancer: carcinogens from tobacco smoke can travel in the bloodstream to the kidney and are taken up by kidney cells.  
• Carcinogens cause mutation of the DNA in the kidney cells, for example p53 gene, leading to uncontrolled mitosis, and tumour formation.  
• Idea of risk of kidney cancer correlating with more than one factor, not just smoking.  
• Linkage of environmental factors (e.g. diet, weight, alcohol consumption, age) to increased risk of cancer-causing mutations.  
• Inheritance of genetic mutations, and increased risk of cancer.  
• The requirement for studies to establish correlations and causal links. |

<table>
<thead>
<tr>
<th>Level</th>
<th>Mark</th>
<th>Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>No rewardable material</td>
</tr>
</tbody>
</table>
| Level 1 | 1–3  | Demonstrates isolated elements of biological knowledge and understanding.  

Provides little or no reference to a range of scientific ideas, processes, techniques and procedures.  

Scientific argument may be attempted, but fails to link biological concepts and/or ideas in order to support decision/conclusion. Limited attempt to address the question. |
<table>
<thead>
<tr>
<th>Level</th>
<th>Mark</th>
<th>Descriptor</th>
</tr>
</thead>
</table>
| Level 2 | 4–6 | Demonstrates adequate biological knowledge and understanding with selection of some biological facts/concepts to support the argument or decision/conclusion being made.  
Scientific reasoning occasionally supported through the linkage of a range of scientific ideas, processes, techniques and procedures.  
Scientific argument is partially developed. Attempts to synthesise and integrate relevant knowledge with linkages to biological concepts and/or ideas, leading to a notional scientific argument or decision/conclusion based on evidence. |
| Level 3 | 7–9 | Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to support the argument or decision/conclusion being made.  
Scientific reasoning supported throughout by sustained linkage of a range of scientific ideas, processes, techniques or procedures.  
Scientific argument is well developed and logical. Demonstrating throughout the skills of synthesising and integrating relevant knowledge with consistent linkages to biological concepts and/or ideas, leading to nuanced and balanced scientific argument or decision/conclusion based on evidence. |
Student answers for part a)

Student answer A

(a) Give two reasons why the ratios of smokers to non-smokers who die from lung cancer are different for males compared with females

The response includes an irrelevant statement followed by one that lacks precision.
Mark awarded = 0

Examiner comments
This response includes an irrelevant statement followed by one that lacks precision.
Mark awarded = 0

Student answer B

(a) Give two reasons why the ratios of smokers to non-smokers who die from lung cancer are different for males compared with females

The first statement in the response is irrelevant and the second is acceptable as the converse of Mp1.
Mark awarded = 1

Examiner comments
The first statement in the response is irrelevant and the second is acceptable as the converse of Mp1.
Mark awarded = 1
Student answer C
(a) Give two reasons why the ratios of smokers to non-smokers who die from lung cancer are different for males compared with females.

- Men smoke more cigarettes than women.
- Women might smoke different types of cigarette e.g. low tar.

Examiner comments
Mp1 is awarded as the statement is the converse. The second bullet point is worthy of Mp2 as the stated example is an appropriate qualification. Mark awarded = 2

Student answers for part b)

Student answer A
(b) These studies suggest that there is a correlation between smoking and lung cancer.

State what is meant by correlation.

A link between two variables but not necessarily a cause. A change in one variable causes a change in the

Examiner comments
This response has an explanation of correlation accompanied by a reference to no cause (causal link). Mark awarded = 1
Student answer B

(b) These studies suggest that there is a correlation between smoking and lung cancer.

State what is meant by correlation.

A relationship between 2 variables

Examiner comments
This response explains correlation but there is no reference to there being no causal link.
Mark awarded = 0

Student answer C

(b) These studies suggest that there is a correlation between smoking and lung cancer.

State what is meant by correlation.

A relationship between two variables but one doesn't cause the other to change.

Examiner comments
Both aspects of the marking point are clearly expressed.
Mark awarded = 1
**Student answers for part d)**

**Student answer A**

*(d) Cancer is the result of the abnormal growth of cells in an organ. These cells develop into a tumour which does not carry out the function of the tissues in the organ.

An article states:

"Tobacco smoke is the cause of kidney cancer!"

Evaluate the claim that tobacco smoke is the primary cause of kidney cancer.

Tobacco smoke contains carcinogens which can cause mutation in human body. These mutations can cause rapid growth of cells which form a tumour. Therefore, there may be a possible correlation between smoking and kidney cancer, but not very strong.

However, tobacco is related via lungs which is where most damage will occur, not kidneys.

No link between lungs and kidneys so not cause or correlation doesn't causation, would need tests to prove results. Ridiculous to say smoke is primary cause.

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**Examiner comments**

This response demonstrates some understanding of what causation means. Very little of the indicative biological knowledge is provided e.g. carcinogens. However, the comment about there being no link between lungs and kidneys demonstrates limited understanding. The idea of the need for more tests to prove causation is implied. The answer touches on each of the level 1 descriptors.

Mark awarded = 3
**Student answer B**

*(d) Cancer is the result of the abnormal growth of cells in an organ. These cells develop into a tumour which does not carry out the function of the tissues in the organ.*

An article states:

"Tobacco smoke is the cause of kidney cancer!"

Evaluate the claim that tobacco smoke is the primary cause of kidney cancer.

Although the article is correct in stating that tobacco smoke causes kidney cancer, it does not justify it being the primary cause. There may be many other causes of cancer developing in the body such as exposure to UV light, as well as other risk factors such as age and genetic factors.

Further more smoking tobacco is more likely to cause cancer to in organs involved in breathing such as lungs, mouth and throat. It is unlikely that smoking tobacco has a huge effect on the kidneys and it is therefore not justified to claim that it is the primary cause of kidney cancer.

**Examiner comments**

This response contains an attempt to provide a balanced argument. Some of the indicative biological knowledge is present. For example, it identifies other risk factors, including exposure to UV light and age. There is also an understanding that tobacco smoke is more likely to have an effect on lungs. This demonstrates an adequate level of knowledge and understanding and touches on the other two level 2 descriptors.

Mark awarded = 4
Student answer C

*(d) Cancer is the result of the abnormal growth of cells in an organ. These cells develop into a tumour which does not carry out the function of the tissues in the organ.

An article states:

"Tobacco smoke is the cause of kidney cancer!"

Evaluate the claim that tobacco smoke is the primary cause of kidney cancer.

Tobacco smoke is made up of smoke particles, gases such as carbon monoxide and tar. The tar contains carcinogens. Carcinogens have been shown to cause tumours. To cause tumours in kidneys, they would have to be transported in the blood. The concentrations that reach the kidneys would need to be high enough to cause the tumours. So there would have to be experiments to show that these cause the tumours and not just a correlation.

There are other risk factors that can affect tumours. Some genes can mutate to cause abnormal cell division. There are some genes that are susceptible to mutation that could be inherited. So it could be that there are risk factors and others such as lifestyle and health interact to cause kidney cancer so it's more than one cause.

Examiner comments

This response demonstrates comprehensive knowledge and includes most of the indicative content. There is a clear understanding of the link between carcinogens and tumours along with genetic and other factors. There is an indication of a logical, balanced argument that includes an understanding of what is required to demonstrate a causal link. All of the level 3 descriptors are touched on but to be worthy of the higher marks the arguments need to be well-developed with sustained linkage.

Mark awarded = 7