

Markscheme

May 2017

Interdisciplinary

On-screen examination

This markscheme is **confidential** and for the exclusive use of examiners in this examination session.

It is the property of the International Baccalaureate and must **not** be reproduced or distributed to any other person without the authorization of the IB Global Centre, Cardiff.

Best fit Approach

'The approach used in assessment in the application of assessment criteria is a "best fit" model. The examiner or teacher applying an assessment criterion must choose the achievement level that overall best matches the piece of work being marked. It is not necessary for every detailed aspect of an achievement level to be satisfied for that level to be awarded but it must reflect the balance of student achievement against the markband. For example, if student work matches two of the three requirements within a markband but one is seriously lacking, the student should be awarded for the strands that have been met well, but the mark awarded should be at the lower end of the markband to compensate for what is lacking in one strand. If the level of student work spans multiple markbands, compensation depends on the performance in the higher order skills. It is worth noting that the highest level of any given criterion does not represent perfection'

Command term	Definition
Outline	Give a brief account or summary.
State*	Give a specific name, value or other brief answer without explanation or calculation.
Identify	Provide an answer from a number of possibilities. Recognize and state briefly a distinguishing fact or feature.
Describe*	Give a detailed account or picture of a situation, event, pattern or process.
Explain*	Give a detailed account including reasons or causes.
Justify*	Give valid reasons or evidence to support an answer or conclusion.
Evaluate*	Make an appraisal by weighing up the strengths and limitations.
Compare and contrast	Give an account of the similarities and differences between two (or more) items or situations, referring to both (all) of them throughout.
Discuss	Offer a considered and balanced review that includes a range of arguments, factors or hypotheses. Opinions or conclusions should be presented clearly and supported by appropriate evidence.
Formulate	Express precisely and systematically the relevant concept(s) or argument(s).
To what extent	Consider the merits or otherwise of an argument or concept. Opinions and conclusions should be presented clearly and supported with appropriate evidence and sound argument.

* These are the command terms used throughout the markscheme.

Note: Before marking, please familiarize yourself with the pre-release material, all sources, the questions and the markscheme.

Question 1a

Choose **three** different maps from above and **identify** their correct classification.

(3 marks)

Award **(1 mark)** for each correct identification, with a maximum of **(3 marks)** in total.

Map 1	Cartogram
Map 2	Physical map
Map 3	Political Map
Map 4	Satellite Map
Map 5	Exploration and land claim map
Map 6	Climate map
Map 7	Satirical map

Question 1b

Using **Source 1**, **explain two** ways in which maps are changing in the 21st century. In your answer you must:

- consider two changes
- consider at least one implication for each change.

(4 marks)

Marks	Descriptor
0	The student does not reach a standard described by any of the descriptors below.
1	The student provides one description of changes in maps in the 21st century or explains one implication.
2	The student <ul style="list-style-type: none"> • describes two changes in maps or <ul style="list-style-type: none"> • describes one change and explains one implication.
3	The student <ul style="list-style-type: none"> • describes two changes in maps and explains one implication or <ul style="list-style-type: none"> • describes one change and explains two implications.
4	The student describes two changes in maps and explains two implications.

Question 1c

Consider your own opinion regarding the objectivity of maps. **Justify** your opinion based on the information provided in **sources 2 to 5**. In your answer you must:

- consider the perspectives expressed in **sources 2 to 5** regarding objectivity of maps
- present your own opinion
- give reasons or evidence to support your opinion.

(8 marks)













Note: Two references from the same source are not valid e.g. Source 2 contains 7 maps

Marks	Descriptor
0	The student does not reach a standard described by any of the descriptors below.
1 – 2	<p>The student:</p> <ul style="list-style-type: none"> • provides a statement regarding the objectivity of maps • point of view may not be clear. <p>There is no use of the sources to support the answer.</p>
3 – 4	<p>The student:</p> <ul style="list-style-type: none"> • provides a description regarding the objectivity of maps • at least one source is used to support the answer.
5 – 6	<p>The student:</p> <ul style="list-style-type: none"> • provides an explanation of their position regarding the objectivity of maps • at least two sources are used to support the answer.
7 – 8	<p>The student:</p> <ul style="list-style-type: none"> • provides a justification of their position regarding the objectivity of maps • at least three sources are used to support the answer. <p>The top answers may use information from beyond the sources in the examination</p>

Question 2a

Choose **one** mathematical related concept that is required in navigation. **Justify** your answer. You must include an example for your related concept.

(3 marks)

Related concepts in mathematics		
 Change	 Equivalence	 Generalization
 Justification	 Measurement	 Models
 Patterns	 Quantity	 Representation
 Simplification	 Space	 Systems

Note: Just selecting a concept does not merit a mark.

Marks	Descriptor
0	The student does not achieve a standard described by any of the descriptors given below.
1	<p>The answer is basic.</p> <p>The student chooses a concept and gives a description linking it to navigation.</p> <p>No example is given.</p>
2	<p>The answer is adequate.</p> <p>The student chooses a concept and explains why that concept is required for navigation.</p> <p>No example is given.</p>
3	<p>The answer is thorough.</p> <p>The student chooses a concept and justifies this using a clear example of why that concept is required for navigation.</p>

Question 2b

Explain why the recording and analysis of data is important in navigation. Give an example to support your answer.

(4 marks)

Marks	Descriptor
0	The student does not achieve a standard described by any of the descriptors given below.
1	<p>The answer is basic.</p> <p>The student</p> <ul style="list-style-type: none"> • states why the recording and analysis of data is important in navigation • no example is given.
2	<p>The answer is adequate.</p> <p>The student</p> <ul style="list-style-type: none"> • describes why the recording and analysis of data is important in navigation • no example is given.
3	<p>The answer is detailed.</p> <p>The student</p> <ul style="list-style-type: none"> • explains why the recording and analysis of data is important in navigation • gives an unclear example to support their explanation.
4	<p>The answer is thorough.</p> <p>The student</p> <ul style="list-style-type: none"> • justifies why the recording and analysis of data is important in navigation • gives a clear example, which directly supports their explanation.

Please turn over

Question 2c

Evaluate the Sun stick method of navigation. In your answer you must:

- identify the advantages of this method
- identify the disadvantages of this method
- suggest times when it would be both useful and not useful
- consider the accuracy of such an application both mathematically and in a real-life context.

(8 marks)

Note: The strands within each mark band are separated by a dotted line for clarity.

Marks	Descriptor
0	The student does not achieve a standard described by any of the descriptors given below.
1 – 2	<p>The answer is limited.</p> <p>The student</p> <ul style="list-style-type: none"> • states when the method could be used with no evaluation of advantages and disadvantages • no reference to mathematics or real life context.
3 – 4	<p>The answer is adequate.</p> <p>The student</p> <ul style="list-style-type: none"> • describes when the method could be used <p>or</p> <ul style="list-style-type: none"> • describes the advantages of the method <p>or</p> <ul style="list-style-type: none"> • describes the disadvantages of the method. <hr/> <ul style="list-style-type: none"> • refers to mathematics is tenuous leading to a conclusion <p>or</p> <ul style="list-style-type: none"> • refers to a real life context is tenuous leading to conclusion.

Question 2c (page 2)

Evaluate the Sun stick method of navigation. In your answer you must:

- identify the advantages of this method
- identify the disadvantages of this method
- suggest times when it would be both useful and not useful
- consider the accuracy of such an application both mathematically and in a real-life context.

(8 marks)

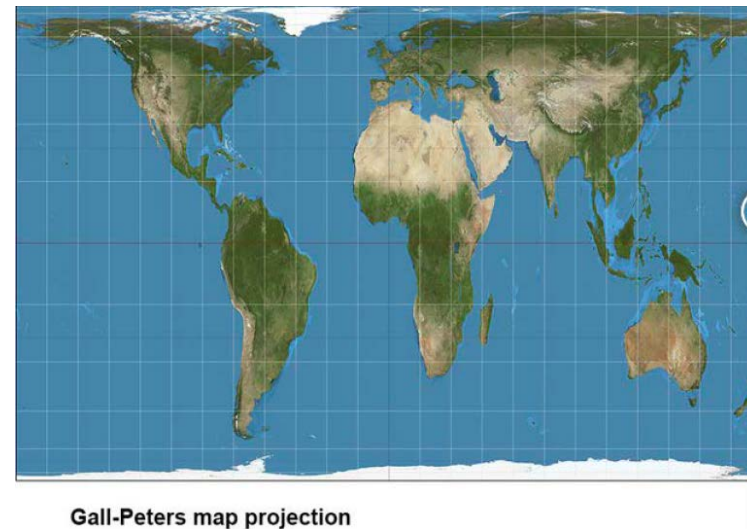
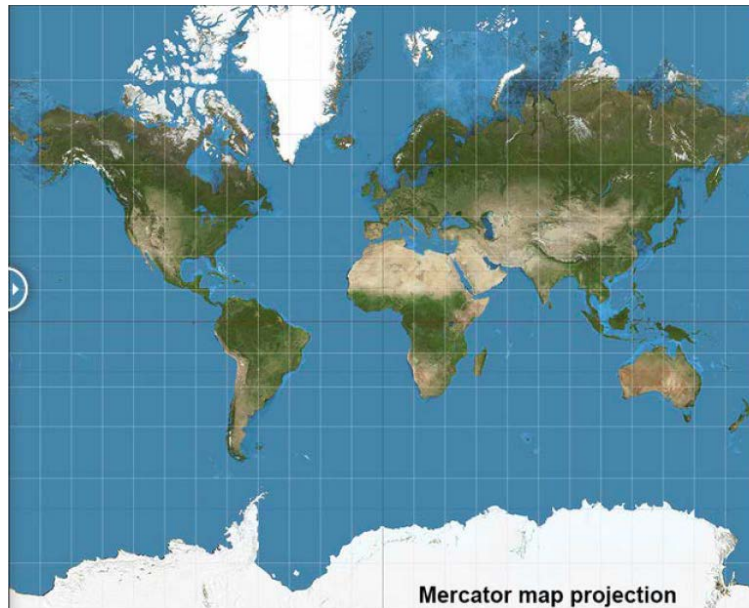
Note: The strands within each mark band are separated by a dotted line for clarity.

5 – 6	<p>The answer is detailed. The student</p> <ul style="list-style-type: none"> • explains when the method could be used <p>and</p> <ul style="list-style-type: none"> • explains the advantages of the method <p>or</p> <ul style="list-style-type: none"> • explains the disadvantages of the method. <hr style="border-top: 1px dotted black;"/> <ul style="list-style-type: none"> • refers to mathematical accuracy to draw a conclusion <p>or</p> <ul style="list-style-type: none"> • refers to a real life context to draw a conclusion.
7 – 8	<p>The answer is thorough. The student</p> <ul style="list-style-type: none"> • evaluates when the method could be used <p>and</p> <ul style="list-style-type: none"> • justifies the advantages of the method <p>and</p> <ul style="list-style-type: none"> • justifies the disadvantages of the method. <hr style="border-top: 1px dotted black;"/> <ul style="list-style-type: none"> • refers explicitly to mathematical accuracy to draw an evaluative conclusion <p>and</p> <ul style="list-style-type: none"> • refers to a real life context to draw an evaluative conclusion.

Question 3a

Compare and contrast the Mercator and Gall-Peters map projections.

(4 marks)



Note: Award (1 mark) for each similarity or difference. A maximum of (2 marks) can be awarded for similarities and a maximum of (2 marks) can be awarded for differences.

Note: Features repeated with slight variations only count once. (For example: They both have green. They both have blue.) Converse arguments may only be counted once. (For example: South America and Africa are larger on the Gall-Peters map. North America and Greenland are smaller on the Gall-Peters map.)

Note: Similarities and differences need to be in the correct box, unless they have clearly stated the response as a difference or similarity.

1 mark for each similarity (up to 2).	For example: colour and shape.
1 mark for each difference (up to 2).	For example: accuracy, functionality, position, power and politics.

Please turn over

Question 3b

Discuss how the Gall-Peters map projection represents scientific and technical innovation. In your answer you must:

- integrate elements from mathematics and individual and societies
- use evidence from the maps to support your argument
- consider strengths and limitations of the Gall-Peters map projection
- provide a conclusion.

(16 marks)

Note: If a response only discusses why or why not the Gall-Peters map is innovative, a maximum of (8 marks) can be awarded.

Note: Strengths and limitations may be considered as evidence for and against the innovation of the Gall-Peters map.

Marks	Descriptor
0	The student does not achieve a standard described by any of the descriptors given below.
1 – 4	<p>The answer is basic.</p> <p>The student</p> <ul style="list-style-type: none"> • states why the map is innovative or why it is not innovative • addresses one of the disciplines in an argument either for or against innovation • provides no evidence from the maps to support their opinions and arguments • does not provide a conclusion. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher.</p>
5 – 8	<p>The answer is adequate.</p> <p>The student</p> <ul style="list-style-type: none"> • describes why the map is innovative or why it is not innovative • addresses both of the disciplines in arguments either for or against innovation • provides one piece of evidence from the maps to support their opinions and arguments • attempts to provide a conclusion. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher.</p>

Question 3b (page 2)

Discuss how the Gall-Peters map projection represents scientific and technical innovation. In your answer you must:

- integrate elements from mathematics and individual and societies
- use evidence from the maps to support your argument
- consider strengths and limitations of the Gall-Peters map projection
- provide a conclusion.

(16 marks)

Note: If a response only discusses why or why not the Gall-Peters map is innovative, a maximum of (8 marks) can be awarded.

Note: Strengths and limitations may be considered as evidence for and against the innovation of the Gall-Peters map.

9 – 12	<p>The answer is thorough.</p> <p>The student</p> <ul style="list-style-type: none"> • explains why the map is innovative and why it is not innovative • addresses both disciplines in both arguments for and against innovation • provides at least two pieces of evidence from the maps to support their opinions and arguments • states a conclusion. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher.</p>
13 – 16	<p>The answer is thorough and balanced.</p> <p>The student</p> <ul style="list-style-type: none"> • justifies why the map is innovative and why it is not innovative • explicitly addresses both disciplines in both arguments for and against innovation • provides at least three pieces of extensive evidence from the maps to support their opinions and arguments • provides a thorough conclusion based on their arguments. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher.</p>

Question 4a Resources

Summary of Source 7: Scientific and technical innovation of exploration		
1. Antarctica	South Pole Expedition	1911
2. Auckland, New Zealand	Waka (Maori Boat)	15 th Century
3. Baikonur, Kazakhstan	Vostok 1	1961
4. Berlin, Germany	Gall-Peters Map	1952
5. Hadar, Ethiopia	Australopithecus (Lucy)	3.2 million years ago
6. Lima, Peru	Kon Tiki Expedition	1947
7. Oslo, Norway	Sun Compass	9 th Century
8. San Francisco, USA	Google Earth	2005

Note: The conditions to meet are 30000km; \$3200; 50 hours. The options for the students are the following:			
Route	Distance/Kms	Cost	Time /Hours
Hadar, Lima, Auckland, Antarctica	28 665	\$3200	57
Hadar, Auckland, Baikonur, Berlin, San Francisco	41 812	\$4700	48
Hadar, Berlin, Baikonur, Auckland, Antarctica	28 264	\$4650	49
*Hadar, Berlin, Baikonur, San Francisco, Lima	27 057	\$2700	44
Hadar, Lima, San Francisco, Berlin, Baikonur	33 071	\$2950	41
Hadar, Lima, San Francisco, Berlin, Oslo	30 250	\$2400	56

***THE ONLY ONE TO ADDRESS ALL CONDITIONS, however with appropriate justification any route could be chosen.**

Please turn over

Question 4a (page 2) Marking criteria

Prepare and **justify** your route for the documentary. In your justification you must:

- visit at least four locations from the ones provided in the map, one of which will be the starting point Hadar
- indicate the budget, time and distance required for your proposal and attempt to stay within the conditions set by the media company
- provide a theme for the documentary
- make connections between the locations
- explain how the locations contribute to the purpose of the documentary
- where necessary, provide reasons for going outside of the conditions set by the media company.

(20 marks)

Marks	Descriptor
0	The student does not achieve a standard described by any of the descriptors given below.
1 – 5	<p>The answer is basic. Answers in this band consist of statements. Answers must address 1-3 of the bullet points.</p> <ul style="list-style-type: none"> • States the locations that will be visited in the documentary • States the budget, time and distance required for the proposal • States a theme for the documentary • States how at least one of the locations contribute to the purpose of the documentary • States a connection between the locations. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher.</p>
6 – 10	<p>The answer is adequate.</p> <p>Answers in this band consist of descriptions. Answers must address at least 3 of the bullet points.</p> <ul style="list-style-type: none"> • Describes the locations that will be visited in the documentary using information from source 7 • Describes the budget, time and distance required including the conditions they did or did not meet • Describes a theme for the documentary • Describes how at least two of the locations contribute to the purpose of the documentary • Describes a connection between the locations. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher.</p>

Question 4a (page 3) Marking criteria continued

Prepare and **justify** your route for the documentary. In your justification you must:

- visit at least four locations from the ones provided in the map, one of which will be the starting point Hadar
- indicate the budget, time and distance required for your proposal and attempt to stay within the conditions set by the media company
- provide a theme for the documentary
- make connections between the locations
- explain how the locations contribute to the purpose of the documentary
- where necessary, provide reasons for going outside of the conditions set by the media company.

(20 marks)

11 – 15	<p>The answer is detailed. Answers in this band consist of explanations. Answers must address at least 4 of the bullet points.</p> <ul style="list-style-type: none"> • Explains the locations that will be visited in the documentary using information from source 7 • Explains the budget, time and distance required for the proposal by providing an explanation of the conditions they did or did not meet • Explains the theme for the documentary • Explains how at least three of the locations contribute to the purpose of the documentary • Explains the connection between the locations. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher</p>
16 – 20	<p>The answer is thorough and perceptive. Answers in this band consist of justifications which will provide reasons with evidence. Answers must address all (5) the bullet points.</p> <ul style="list-style-type: none"> • Justifies the locations that will be visited in the documentary using information from source 7 to support their decision • Justifies the budget, time and distance required for the proposal by providing an explanation with evidence for the conditions they did or did not meet • Justifies the theme for the documentary using evidence • Justifies how at least four of the locations contribute to the purpose of the documentary using evidence • Justifies the connection between the locations using evidence. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher.</p>

Question 4b

Explain how you have prepared an effective travel route. In your answer, you must include the following considerations:

- Given the conditions and brief, how does your route and justification combine mathematics **and** individuals and societies to meet the purpose of the documentary?
- What information did you provide to the audience and why?
- Why would people want to watch your documentary?

(10 marks)

Note: Only a maximum of (2 marks) can be awarded if only one discipline is addressed

Marks	Descriptor
0	The student does not achieve a standard described by any of the descriptors given below.
1 – 2	<p>The answer is basic</p> <p>The student:</p> <ul style="list-style-type: none"> • states the answer to one of the three sub-questions (combining disciplines, about info provided and why people would watch the documentary) in basic/simplistic terms • does not provide evidence beyond repeating or paraphrasing their answer from question 4a. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher.</p>
3 – 5	<p>The answer is adequate</p> <p>The student:</p> <ul style="list-style-type: none"> • describes the answer to one or two of the three sub-questions (combining disciplines, about info provided and why people would watch the documentary) • provides limited evidence that refers to the different elements of the route. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher</p>
6 – 7	<p>The answer is balanced</p> <p>The student:</p> <ul style="list-style-type: none"> • explains the answer to all three of the three sub-questions (with valid points/statements about combining disciplines, about info provided and why people would watch the documentary), although one sub-question may be answered in basic/simplistic terms • provides evidence that refers to the different elements of the route. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher.</p>
8 – 10	<p>The answer is thorough</p> <p>The student:</p> <ul style="list-style-type: none"> • clearly explains the answer to all three sub-questions equally, developing answers (about combining disciplines, about info provided and why people would watch the documentary) • provides clear evidence that refers to the different elements of the route. <p>Within this markband, answers that communicate the ideas clearly and coherently will score higher.</p>

Question 5

You work for a national space programme and have been asked to create an action plan to assess the viability of a human settlement on Mars. **Formulate three** research questions and the method you would use to research each question. In your answer you must:

- consider both mathematics and individuals and societies
- consider the characteristics of good research questions
- include an appropriate research method to address each question
- consider relevant information from the pre-release material.

(10 marks)

Note: This will appear on all responses, please do not mark: **To what extent is it viable to settle on Mars?**

Note: If the student only has questions, the score must be in the 1-2 band.

Note: References to mathematics and individuals and societies may be implicit up until the 8-10 band.

Marks	Descriptor
0	The student does not achieve a standard described by any of the descriptors given below.
1 – 2	<ul style="list-style-type: none"> • The questions are not always clear. • Methods selected are not appropriate for the question • The response considers mathematics or individuals and societies.
3 – 5	<p>At least two questions and methods need to be given to achieve this descriptor.</p> <ul style="list-style-type: none"> • The questions are clear • Methods selected are sometimes (one out of three methods) appropriate for the question • The response considers mathematics or individuals and societies.
6 – 7	<p>All three questions and methods need to be given to achieve this descriptor.</p> <ul style="list-style-type: none"> • The questions are mostly focused and clear • Methods selected are mostly (two out of three methods) appropriate for the question • The response considers both mathematics and individuals and societies.
8 – 10	<p>All three questions and methods need to be given to achieve this descriptor.</p> <ul style="list-style-type: none"> • The questions are focused and clear • Methods selected are all (three out of three methods) appropriate for the question • The response explicitly considers both mathematics and individuals and societies in a balanced manner.

Question 6a

Imagination and reason are both motivations for exploration. Match the major scientific and technical innovations to **either** imagination **or** reason. **Outline** your reasoning.

(4 marks)

Note: Marks are only awarded for the outline of reasoning and not the placement of the innovations
Note: The first response textbox is for ‘Imagination’ and the second response textbook is for ‘Reason’.

Marks	Descriptor
0	The student does not achieve a standard described by any of the descriptors given below.
1	The answer is basic . The student outlines why they matched one innovation to imagination and/or reason.
2	The answer is adequate . The student outlines why they matched two innovations to imagination and/or reason.
3	The answer is thorough . The student outlines why they matched three innovations to imagination and/or reason.
4	The answer is thorough and balanced . The student outlines why they matched all (four) of the innovations to imagination and/or reason.

Please turn over

Question 6b

Evaluate the role of imagination and reason in exploration. In your answer you must:

- consider the benefits and limitations of imagination in deciding to explore
- consider the benefits and limitations of reason in deciding to explore
- include a conclusion about the importance of deciding to explore, based on the arguments presented
- use **Source 9** in your evaluation.

(16 marks)

Marks	Descriptor
0	The student does not achieve a standard described by any of the descriptors given below.
1 – 4	<p>The answer is limited.</p> <p>The student:</p> <ul style="list-style-type: none"> • states: Benefits of imagination or Benefits of reason or Limitations of imagination or Limitations of reason • does not write a conclusion.
5 – 8	<p>The answer is adequate.</p> <p>The student:</p> <ul style="list-style-type: none"> • describes: Benefits of imagination or Benefits of reason or Limitations of imagination or Limitations of reason • attempts a conclusion.

Question 6b (page 2)

Evaluate the role of imagination and reason in exploration. In your answer you must:

- consider the benefits and limitations of imagination in deciding to explore
- consider the benefits and limitations of reason in deciding to explore
- include a conclusion about the importance of deciding to explore, based on the arguments presented
- use **Source 9** in your evaluation.

(16 marks)

Marks	Descriptor
9 – 12	<p>The answer is detailed.</p> <p>The student:</p> <ul style="list-style-type: none"> • explains: <ul style="list-style-type: none"> Benefits and limitations of imagination or Benefits and limitations of reason or Benefits of both imagination and reason or Limitations of both imagination and reason • writes a conclusion.
13 – 16	<p>The answer is thorough.</p> <p>The student:</p> <ul style="list-style-type: none"> • justifies the benefits and limitations of both imagination and reason • writes an evaluative conclusion.

Question 7

Choose **one** major scientific and technical innovation from the timeline. **To what extent** does your chosen innovation demonstrate progress in exploration? In your answer you must:

- refer to the **global context** focus “adaptation, ingenuity and progress”
- use evidence from the **pre-release material** to support your argument
- write a **conclusion** about how your choice demonstrates progress.

(10 marks)

Marks	Descriptor
0	The student does not achieve a standard described by any of the descriptors given below.
1 – 2	<p>The answer is limited.</p> <p>The student:</p> <ul style="list-style-type: none"> • superficially states how their choice demonstrates adaption or ingenuity • does not conclude about how their choice demonstrates progress.
3 – 5	<p>The answer is adequate.</p> <p>The student:</p> <ul style="list-style-type: none"> • describes how their choice demonstrates adaption or ingenuity • attempts to use evidence from the PRM to support their arguments • attempts a conclusion about how their choice demonstrates progress.
6 – 7	<p>The answer is detailed.</p> <p>The student:</p> <ul style="list-style-type: none"> • explains how their choice demonstrates adaptation and ingenuity • Uses evidence from the PRM to support their arguments • states a conclusion about how their choice demonstrates progress.
8 – 10	<p>The answer is thorough and perceptive.</p> <p>The student</p> <ul style="list-style-type: none"> • discusses thoroughly how their choice demonstrates adaptation and ingenuity • Using evidence from the PRM and beyond to support their arguments • writes a thorough conclusion about how their choice demonstrates progress as a result of the arguments presented.