Rewarding Learning

ADVANCED
General Certificate of Education
2018

Geography

Assessment Unit A2 2
assessing
Physical Geography and Decision Making

[AG221]

FRIDAY 8 JUNE, AFTERNOON

MARK SCHEME

MARK SCHEMES

Foreword

Introduction

Mark Schemes are published to assist teachers and students in the preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of 16- to 18-year-old students in schools and colleges. The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes therefore are regarded as a part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published; the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.

Introductory Remarks

The assessment objectives (AOs) for this specification are listed below. Students must:

AO1 demonstrate knowledge and understanding of the content, concepts and processes;

AO2 analyse, interpret and evaluate geographical information, issues and viewpoints and apply understanding in unfamiliar contexts;

AO3 select and use a variety of methods, skills and techniques (including the use of new technologies) to investigate questions and issues, reach conclusions and communicate findings.

General Instructions for Markers

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all markers are following exactly the same instructions and making the same judgements so far as this is possible. Markers must apply the mark scheme in a consistent manner and to the standard agreed at the standardising meeting.

It is important to recognise that in some cases there may be other correct responses that are equally acceptable to those included in this mark scheme. There may be instances where certain judgements have to be left to the experience of the examiner, for example, where there is no absolute, correct answer.

Markers are advised that there is no correlation between length and quality of response. Candidates may provide a very concise answer that fully addresses the requirements of the question and is therefore worthy of full or almost full marks. Alternatively, a candidate may provide a very long answer which also addresses the requirements of the question and is equally worthy of full or almost full marks. It is important, therefore, not to be influenced by the length of the candidate's response but rather by the extent to which the requirements of the mark scheme have been met.

Some candidates may present answers in writing that is difficult to read. Markers should take time to establish what points are being expressed before deciding on a mark allocation. However, candidates should present answers which are legible and markers should not spend a disproportionate amount of time trying to decipher writing that is illegible.

Levels of Response

For questions with an allocation of six or more marks three levels of response will be provided to help guide the marking process. General descriptions of the criteria governing levels of response mark schemes are set out on the next page. When deciding about the level of a response, a "best fit" approach should be taken. It will not be necessary for a response to meet the requirements of all the criteria within any given level for that level to be awarded. For example, a Level 3 response does not require all of the possible knowledge and understanding which might be realistically expected from an AS or AL candidate to be present in the answer.

Having decided that the level is, it is then important that a mark from within the range for that level, which accurately reflects the value of the candidate's answer, is awarded.

General Descriptions for Marking Criteria

Knowledge and Understanding	Skills	Quality of Written Communication	Level
The candidate will show a wide-ranging and accurate knowledge and a clear understanding of the concepts/ideas relevant to the question. All or most of the knowledge and understanding that can be expected is given.	The candidate will display a high level of ability through insightful analysis and interpretation of the resource material with little or no gaps, errors or misapprehensions. All that is significant is extracted from the resource material.	The candidate will express complex subject matter using an appropriate form and style of writing. Material included in the answers will be relevant and clearly organised. It will involve the use of specialist vocabulary and be written legibly and with few, if any, errors in spelling, punctuation and grammar.	3
The candidate will display an accurate to good knowledge and understanding of many of the relevant concepts/ ideas. Much of the body of knowledge that can be expected is given.	The candidate will display evidence of the ability to analyse and interpret the resource material but gaps, errors or misapprehensions may be in evidence.	The candidate will express ideas using an appropriate form and style of writing. Material included will be relevant and organised but arguments may stray from the main point. Some specialist terms will be used and there may be occasional errors in spelling, punctuation and grammar. Legibility is satisfactory.	2
The candidate will display some accurate knowledge and understanding but alongside errors and significant gaps. The relevance of the information to the question may be tenuous.	The candidate will be able to show only limited ability to analyse and interpret the resource material and gaps, errors or misapprehensions may be clearly evidenced.	The candidate will have a form and style of writing which is not fluent. Only relatively simple ideas can be dealt with competently. Material included may have dubious relevance. There will be noticeable errors in spelling, punctuation and grammar. Writing may be illegible in places.	1

Section A

Option A: Fluvial and Coastal Environments

AVAILABLE MARKS

1 (a) Candidates are expected to make reference to the resources to identify and describe **two** ways in which the stretch of coastline has been subjected to increasing demands.

Level 3 ([7]–[8])
At least two varied demands are presented in the relevant context and with clarity. The response is strongly supported by specific detail/information gleaned from the resources. Use of appropriate terminology is good.

Level 2 ([4]–[6])
Although at least two varied demands are presented in the relevant context, there may be a lack of clarity. There is some, albeit restricted, support from resource-based information. Use of appropriate terminology may be restricted.

Level 1 ([1]–[3]
Only one demand may be presented or comments are not placed in the relevant context. The response may not be supported by information gleaned from the resources. Use of appropriate terminology may be poor. [8]

(b) The candidate should present an annotated diagram/s to support an explanation of the way in which the chosen landform was created. Explanation presented as annotation is acceptable. The specification requires knowledge of spits, tombolos and dunes.

Level 3 ([6]–[7])
An accurate, relevant and well-presented diagram/s is/are given, along with a clear explanation of the chosen landform's creation. Depth and details are present. There is good use of appropriate terminology.

Level 2 ([3]–[5])
Either the diagram/s or explanation of the landform's creation is incomplete in a significant way (such as restricted depth and detail or poor quality of construction). There may be restricted use of appropriate terminology.

Level 1 ([1]–[2])
No diagram is presented or the diagram/s is/are irrelevant or very weak. The explanation of the landform's creation may be very restricted in depth, quality or relevance. Use of terminology may be poor. [7]

(c) The candidate is asked to describe the strategies used to achieve the aims of a regional river basin management scheme and evaluate their effectiveness.

Level 3 ([11]–[15])
The answer refers to an appropriate and relevant case study example. Candidates at this level address each element of the question explicitly (description of strategies, evaluation of effectiveness) and with validity and clarity. A high level of appropriate case study detail is given. Terminology is good.

Level 2 ([6]–[10])
The answer refers to an appropriate and relevant case study example. Although candidates at this level address each element of the question (description of strategies, evaluation of effectiveness) the response may be

imbalanced or there may be some lack of clarity, validity and/or depth. Case study detail may be restricted. Terminology may be restricted.

Level 1 ([1]–[5])
The answer may refer to a case study of an inappropriate scale or nature. One or more elements of the question (description of strategies, evaluation of effectiveness) may be neglected. Case study detail may be very restricted. The response may be a cursory one. Terminology may be poor. [15]

AVAILABLE MARKS

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AVAILABLE MARKS

2 **(a)** The question demands identification of two differing strategies for river flood control (containment by man-made floodbanks and flood basins), as well as a statement and justification of the candidate's view on which of the strategies is the most environmentally sustainable option.

Level 3 ([7]–[8])
All aspects of the question are addressed (strategy identification, statement and justification) and fully developed. The response is relevant to the context of the resources. The use of terminology is good.

Level 2 ([4]–[6])
Although all aspects of the question are addressed (strategy identification, statement and justification), development may be restricted. The response is relevant to the context of the resources. The use of terminology may be restricted.

Level 1 ([1]–[3])
The candidate may omit one or more aspects of the question (strategy identification, statement and justification), or present invalid or cursory comments. The response may lack relevance to the context of the resources. The use of terminology may be poor. [8]

(b) The question demands more than one reference to place, along with an explanation as to why the demands upon rivers and their valleys of any of the two options are increasing.

Level 3 ([6]–[7])
At least one valid place reference is made for each demand noted, along with some development. The explanation for the increasing demand upon rivers and their valleys by domestic/residential, industry or leisure is valid and detailed. The use of terminology is good.

Level 2 ([3]–[5])
At least one valid place reference is made although, perhaps, not developed. The explanation for the increasing demand upon rivers and their valleys by domestic/residential, industry or leisure is valid, but depth/details may be restricted. The use of terminology may be restricted.

Level 1 ([1]–[2])
The candidate may omit reference to place, or make invalid references to place. The explanation for the increasing demand upon rivers and their valleys by domestic/residential, industry or leisure may lack validity and/or depth/details. The use of terminology may be poor. [7]

(c) The candidate is asked to describe the engineering strategies used and evaluate their effectiveness with reference to a regional case study of coastal protection.

Level 3 ([11]–[15])
The answer refers to an appropriate and relevant case study example. Candidates at this level address each element of the question explicitly (description of strategies/evaluation of their effectiveness) and with validity and clarity. A high level of appropriate case study detail is given. Terminology is good.

Level 2 ([6]–[10])
The answer refers to an appropriate and relevant case study example. Although candidates at this level address each element of the question (description of strategies/evaluation of their effectiveness), the response may be imbalanced or there may be some lack of clarity, validity and/or depth. Case study detail may be restricted. Terminology may be restricted.

Level 1 ([1]–[5])
The answer may refer to a case study of an inappropriate scale or nature. One or more elements of the question (description of strategies/evaluation of their effectiveness) may be neglected. Case study detail may be very restricted. The response may be a cursory one. Terminology may be poor.

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Option B: The Nature and Sustainability of Tropical Ecosystems

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3 **(a)** A description of the global distribution of any **two** of the **three** named tropical biomes is required. Tropical forest: about one quarter of the tropics' land area is covered by forest, representing 5% of the Earth's surface area. Tropical forest coverage is declining significantly in many regions. Most forest lies between 10˚ north and south of the Equator with three concentrations of the biome:

- **Latin America**, including the Amazon and Orinoco basins containing 56% of the world total;
- Western Equatorial **Africa**, including the Congo basin (18%); and
- South-East **Asia** (25%).

The tropical (hot) desert biome is found across a range of continents most lying between 15˚ and 30˚ north and south of the Equator and commonly in the centre or on western coasts. In the northern hemisphere are the Sonora Desert of south-west USA (**North America**) and the largest of all deserts, the Sahara, across North **Africa**. Further east the hot desert biome runs across Saudi Arabia, through Iran to the Thar Desert of Pakistan in **Asia**. Their counterparts in the southern hemisphere are the Atacama desert of **South America**, the Namib/Kalahari desert of southern **Africa** and the Great Australia Desert.

Tropical grassland or savanna is found over a wide zone within the tropics. This biome incorporates a range of vegetation communities, from open woodland with grass, through pure grasslands to scrub. Most are located between 5˚ and 20˚ north and south of the Equator. **Africa** dominates the distribution with a belt stretching across the continent from West to East Africa and as far as Zambia in the south. In **South America** it comprises the Llanos of Venezuela and the Campos of the Brazilian Plateau. Finally, in north **Australia**, Queensland and the Northern Territory have tropical grasslands.
(2 × [4]) [8]

(b) Candidates are required to use the resource to compare in an evaluative way the merits or otherwise of the two agricultural systems. In their answer each of the sustainability aspects, economic and environment should be addressed. Sustainable development balances the needs of the current population with those of the future and strives to maintain the environmental security of the ecosystem.
Economic: – the low costs, reliability, higher tenure capacity, yield and high productivity favours the Milpa system; Environmental: – the high and stable productivity under the Milpa system along with its reliability and species diversity makes it a more attractive option from the view of sustainability. A similar argument can be made by discussion of the negatives of the Tobacco plantation

Level 3 ([6]–[7])
A good awareness of sustainability in development is demonstrated and the resource is used to justify an evaluation of the two systems with respect to both the economic and environmental aspects.

Level 2 ([3]–[5])
An answer that uses the resource to address the two named elements but neglects the explanation of sustainable development would be confined to this level. Alternatively, if the explanation of such development is provided but it or the evaluation of the resource material is restricted in its depth or clarity this level would be appropriate.

Level 1 ([1]–[2])
Answers that lack evaluation of the agricultural systems in terms of sustainability would be restricted to this level. The response may be cursory. [7]

(c) A regional study is required (often the Amazon Basin) and the description and explanation should be related to that specific study. Three aspects are identified: biomass, productivity and trophic structure. Biomass: the nature, scale and role of the living organisms in the case study named; Productivity: the rate of production of organic material with appropriate figures; Trophic structure: this might include an accurate description of the links between plant and animal species in context. It is possible that the description and or explanation of the three elements will overlap and inter-relate, a key is the understanding shown of each and the use of appropriate details for the study selected.

Level 3 ([11]–[15])
All three elements are described and explained with accuracy and case study appropriate material is provided. Terminology is good.

Level 2 ([6]–[10])
An answer in which one of the three elements is omitted or inadequately described or explained would be restricted to level 2. Alternatively an answer that makes little use of case study material, beyond a named region would be confined to this level. Terminology may be limited.

Level 1 ([1]–[5])
Answers at this level include those with an absence of any valid study reference or one in which more than one of the three elements is not described or explained. Terminology may be poor. [15]

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4 **(a)** The answer requires an explanation of how the Hadley circulation and the ITCZ create the climatic conditions necessary for BOTH the tropical forest and desert biomes.
From the resource tropical forest requires high mean annual temperatures (25–28°C) and annual rainfall of over 1700 mm. In the Hadley Cell rainfall is associated with the meeting of the surface trade winds at the Inter-tropical Convergence Zone (ITCZ) where air rises and cools. While the ITCZ moves annually with latitude following the position of the overhead sun it ensures that the region within a few degrees of the Equator receives significant rain throughout the year. At the same time the sun remains high in the sky and day length varies little with the seasons ensuring a constantly high level of insolation.
Desert biomes are found beneath the subsiding limb of the Hadley circulation about 30°N and S of the Equator. Under descending air high pressure forms restricting the development of cloud. This accounts for the very low annual rainfall figures shown in the resource (less than 300 mm). The significant variation in temperatures found (7–26°C) is due to the shifting position of the sun, overhead at each Tropic (23½°N and S) in June and December respectively. Distribution of desert includes non-tropical, i.e. temperate desert.

Level 3 ([7]–[8])
Detail of the climatic characteristics for both biomes is described from the resource and the Hadley cell and ITCZ are used in a valid explanation of each biome's climatic nature.

Level 2 ([4]–[6])
Answers may be confined to this level if details of the characteristics and explanation of only one biome are provided. Alternatively, an imprecise description and/or explanation of both biomes' climatic characteristics with respect to the required circulation features would be similarly restricted.

Level 1 ([1]–[3])
The absence of resource use or any valid explanation using the ITCZ and/or Hadley would confine an answer to this level. Alternatively, the answer may be cursory. [8]

(b) Zonal soil named as oxisol, latosol or ferralitic soil ([1]). For any two distinctive characteristics, description and explanation (2 × [3]). These characteristics may include:

Characteristic	Description	Explanation
Depth	Deep from 4 to 10 m	Ancient stable climate, deep chemical and biological weathering due to abundant heat and soil moisture
Colour	Red or Red/Brown	Dominance of sesquioxides of iron and aluminium due to severe leaching (wet climate 1800+ mm)
Profile	Shallow A horizon, deep B1 and B2	Chemical weathering, leaching due to hot, wet climate and efficient extraction of nutrients
Chemistry	Acid pH around 4–4.5	Strong leaching of nutrient positive ions replaced by H+ ions in B horizon
Fertility	Ah horizon thin, little storage of nutrients	Combination of leaching due to wet climate and the rapid transfer of plant nutrients through root systems

[7]

		AVAILABLE MARKS
(c)	The question focuses on both the causes and the impacts of salinisation issue. In both cases the answer must be illustrated from a regional scale case study. Impacts for both the environment and people are specified. **Level 3 ([11]–[15])** The answer explains the causes of salinisation and its impacts on both people and the environment. Each aspect is explained in the context of a relevant study region. Valid terminology is used and a range of facts and study detail is provided. **Level 2 ([6]–[10])** A relevant case study is provided with a description of the causes and impacts of salinisation but the explanation given and/or the regional context material is limited. **Level 1 ([1]–[5])** Answers that fail to develop any one or more of the key elements – a relevant case study, causes or impacts – would be confined to this level. Alternatively, the answer lacks factual detail or the use of appropriate terminology. [15]	30

Option C: The Dynamic Earth

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5 **(a)** Resource 5A, shows the South Sandwich Islands Arc and ocean trench. Resource 5B shows the Hawaiian island chain for which the tectonic processes involved in their creation is the movement of an ocean plate by upper mantle convection over a fixed hot spot in the mantle beneath. The tectonic processes responsible for these features is the subduction of the South American plate beneath the South Sandwich Plate driven by convection currents in the asthenosphere. For each the sequence and formation processes need to be clearly identified and tied directly with the details of the resources, such as the dates of the island ages in Hawaii and the parallel link between the trench and volcanic island arc in the South Sandwich islands.
(2 × [4]) [8]

(b) Various methods that are employed in the prediction of earthquakes should be discussed and the restrictions that these have should be clearly identified. Answers may be expected to describe seismic gap theory and the monitoring of changes linked to stressed crust (dilation) such as water levels, deformation, gas release, etc. No case study or location material is required though this may be valid if it identified methods and limitations. The lack of past success in prediction along with issues of timing, scale and impact area may form the basis of discussion on the limitations.

Level 3 ([6]–[7])
A sound range of valid methods is described as the 'efforts' made and there is equally appropriate explanation of how such predictions are limited with respect to earthquake activity.

Level 2 ([3]–[5])
Both a description of methods and some explanation of the limitations are given, but the depth and detail of one or other is significantly restricted.

Level 1 ([1]–[2])
At this level one or other of the key requirements, description of efforts or explanation of limitations is overlooked. Alternatively, a very limited reference to both and poor use of relevant terminology would confine an answer to this level. [7]

(c) A discussion of the statement is the focus of this question and candidates may choose to agree or disagree. What is required is clear reference to two case studies (one in an LEDC context and one MEDC). The role of stage of development is described in context and probably seen as a major factor. It is expected that other factors are noted in particular, knowledge and perception, though their role may be seen as being influenced by stage of development in turn.

Level 3 ([11]–[15])
Two valid studies (one MEDC one LEDC) are quoted and accurate detail of how their management was influenced by stage of development is provided. The role of other factors is also discussed though their significance may be seen as minor or otherwise. Terminology is good.

Level 2 ([6]–[10])
Two valid studies are discussed but the depth and relevance of either the factual management detail or the discussion of the influencing factors is limited. Terminology may be restricted.

Level 1 ([1]–[5])
The lack of one of the two studies or a response that merely describes studies with no discussion of the factors influencing management would be restricted to level 1. Terminology may be poor. [15]

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6 (a) In each case reward clear causal links to seismic activity.

A **Seismic shaking:** The collapse of housing and structures in the built environment are primarily caused by the repeated shaking of their foundations by seismic waves reaching the surface.

B **Liquefaction:** The cracking of the tarmac runway and the emergence of sand onto the ground surface are common symptoms of liquefaction. Unconsolidated ground especially when saturated will act as a liquid when subject to violent shaking. The internal cohesion of material fails and structures will tilt or sink downwards under their own weight.

C **Seismic shaking/ground deformation:** This could be a consequence of damage to the built environment. The destruction of gas or oil pipelines along with electricity cables can create fires, or where paraffin or gas stoves were upset by seismic shaking setting flammable materials alight. Ground deformation or even liquefaction may cause damage to water pipelines making it difficult to fight fires directly.

D **Landslides:** The downhill movement of soil and rock material may be initiated by the ground shaking of an earthquake. As a trigger mechanism this can generate movement on unstable slopes at both a small local scale or regionally. The impacts may be environmental, scarring hillslopes or diverting and blocking rivers causing floods or directly impact on the built environment with homes/settlements and infrastructure destroyed on the failing slopes or by the landslide debris at the base of the slope.

E **Ground deformation:** Relatively unusual, but linked to large shallow earthquakes. Land on one side of the moving fault line is forced upwards or thrown down relative to the other, leading to the appearance of a step or cliff line running across the ground surface.

F **Tsunami:** Significant movement along a section of ocean floor at a plate margin displaces water and triggers a deep water long wave. With a huge wavelength and low amplitude these waves radiate from the epicenter at high speed and rear upwards into a series of large walls of water as they approach shallow water near land.

Level 3 ([7]–[8])
Three impacts are accurately identified and appropriately explained and linked to the earthquake effects. Good use of relevant terminology demonstrated.

Level 2 ([4]–[6])
Although the three explanations are identified, they lack depth and clarity. Alternatively only two are accurately identified.

Level 1 ([1]–[3])
Only one valid link is correctly identified, or if more than one the explanations given are limited and the terminology used is poor. [8]

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(b)	A diagram is required along with description and explanation of one of these two plate margins – destructive or conservative. The diagram may be an outline one, usually a cross-section. Both the creative processes and the landforms produced have to be clarified. **Destructive** – Convection currents, converging plates, subduction, melting plate material, rising magma, plates, asthenosphere, deep ocean trench, plunging leading edge, Benioff zone, volcanoes/island arcs. **Conservative** – convection currents, upper mantle, sliding plates, friction/ stress, earthquake, seismic waves, elastic rebound, a lack of construction or destruction of plate material, a lack of volcanic activity, fold mountains. **Level 3 ([6]–[7])** A valid, clearly presented diagram is provided with an accurate explanation of the processes involved at the margin and the landforms created identified in context. Good terminology is used throughout. **Level 2 ([3]–[5])** A valid diagram is provided, but the explanation is incomplete with respect to the detail of the process involved or the landforms created. **Level 1 ([1]–[2])** The answer lacks a valid diagram or any explanation is very restricted on process and/or landforms. [7]	
(c)	The focus of the question is on volcanic benefits. Each of the three areas is identified – society, economy and environment, and for all of these reference to places for illustration are required. **Level 3 ([11]–[15])** A range of benefits is accurately described and each of the three areas is evaluated. Relevant places are given for illustration. Terminology is appropriate and the answer is well balanced across the three aspects. **Level 2 ([6]–[10])** Whilst a range of benefits, reference to place and evaluation are given, depth, detail and accuracy may be restricted or the answer unbalanced. Terminology may be restricted. **Level 1 ([1]–[5])** A lack of relevant places, description of benefits or evaluation would confine an answer to this level. Poor or inappropriate terminology may be used. [15]	30
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7 Introduction: some guiding principles

The ideas outlined in the 'Guidance on Content' section are lines of thought that candidates might take in their report. They are not to be seen as the definitive answer, though it is to be expected that the points outlined below will feature, if only in part, in most answers. When allocating marks look favourably on answers which:

(a) avoid undue verbatim quoting from Resource Booklet and adopt a consistent style;

(b) use the full range of the resource material appropriate to the task – particularly where it is provided in non-literary format such as printed maps and photographs;

(c) apply knowledge and concepts that are not specifically raised in the resource material, yet are both illuminating and relevant to the task;

(d) maximise opportunities presented by the resource material;

(e) appreciate that "bias" might exist in resource material which expresses particular views;

(f) avoid undue repetition of the same answer material in different sections or, if overlap is unavoidable, present it in a fresh way;

(g) back up points with specific detail, e.g. giving statistical information where it is provided rather than making vague statements when details are readily available.

Guidance on content

A. Introduction (Briefly describe the proposed project and discuss the need for it.)

It is proposed that a pipeline be built to take 4 cubic metres of water per second from the Parteen Basin, a southern extension of Lough Derg, in the River Shannon. The water will be treated in a new treatment plant at Birdhill, next to the Parteen Basin. It will then be transported along a 170 kilometre pipeline to a reservoir at Peamount, just west of Dublin. This pipeline will cost €1.2 billion and will take the water from the Shannon 170 kilometres across four Irish counties (Tipperary, Laois, Offaly, Kildare) to a Terminal Reservoir just west of Dublin. The roughly 2 metre wide pipe will be largely underground, buried in a 4 metre deep trench, but will need regular access points for maintenance. The plan will also require microtunnelling under seven rivers. Irish Water are the company who have proposed the development, and it is anticipated that the building of the pipeline will start in 2019, aiming to have it complete by 2024. Meanwhile, the water flow in the Old River Shannon below the Parteen Weir will be kept at 10 cumecs and the flow to Arnacrusha HEP station will be kept at 166 cumecs on average.

This project is important because Dublin requires large quantities of water and, if the city is to develop in the future, there must be a reliable supply, which grows as demand increases. This has to be in place over the next 10 to 15 years, which means developing the new supply must be started now.

If Ireland's ageing water pipeline network were to fail catastrophically, there is a very real risk of a disruption to water supply. However, Ireland's growing

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population, particularly in the most populated regions around Dublin, must be supplied with water. The population of Dublin is forecast to rise from 1.5 million in 2011 to 2.1 million by 2050. Useage also is predicted to rise, with non-domestic use rising from 125 million litres per day (mld) in 2011 to up to 281 mld by 2050.

Level 3 ([7]–[8])
The candidate clearly, although briefly, describes the project and discusses the need for it. Both are considered fully. Precise figures and facts will be used where possible, particularly from the maps, diagrams and infographics.

Level 2 ([4]–[6])
The candidate makes fewer clear and correct points. There is little or no development of any point, but points made are valid. There may be a major imbalance between the description of the project and need for it, or there may be a lack of detail. The answer may concentrate on the more limited information in the text resources.

Level 1 ([1]–[3])
The candidate presents little content and a lot of it is irrelevant to the need for the development or the description of it. Some of the points made may lack validity. There may be excessive verbatim use of resources. [8] 8

B The likely impact

(i) Discuss the possible beneficial effects of the proposed development on people and the economy and the counterarguments.

Over 40% of Ireland's population work and live in the Midlands and Eastern Region, including the capital city, Dublin, and this project, if approved, will provide a sustainable water supply to these people and to the industries of the region. It will address the problem of the supply of water not being able to meet demand at peak times, which is forecast to happen between 2016 and 2020 (Table 1). While the people of this region will benefit from the improvement to the water infrastructure, all of the country will benefit from the economic growth that the improvement will deliver, including additional employment and improvements in standards of living across Ireland. The whole country will be wealthier as a result of this scheme.

The proposed scheme will create employment, and invest €504 million in construction jobs. The cost of construction plant is estimated at a further €136 million. In additional materials for the construction are estimated at €186 million. In other words, €826 million will go into local businesses and workers' salaries, and the pipeline will use local suppliers as much as possible. There is an expectation that 1000 jobs will be created to construct the pipeline. The company is planning to work with a local University and with Technology colleges to ensure that local people gain the skills they need to work on the project. Even after the project has been completed in 2024, there will still be permanent jobs in water treatment (15 jobs) and in maintenance (3 jobs). Openings for about 75 part-time or contract workers are also anticipated as well as permanent employment for 3 data or research scientists.

People along the route will also benefit in other ways. A Community Benefit Fund will be established with €8 million invested by Irish Water.

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In addition, each year up to another million euros will be paid in by the company. This fund will benefit communities along the route of the pipeline, with a 'range of community-related initiatives'. Tourism will benefit from the Fund too, with support provided through the Lakelands Project in the Lower Shannon and support for the Interpretive Centre in Lough Derg. Sports and play facilities such as water sports and playgrounds will also be supported. In addition Irish Water will be very careful to protect the environment as they recognise that it is that environment which is the key to tourism along the Shannon, especially in Lough Derg. By being so careful, they will help to preserve this important industry.

Industries in this part of Ireland include agri-food as well as pharmaceutical and ICT-related companies. All of these industries require a large amount of water to operate, and this scheme will provide that, and allow the industries to grow further. Most of the world's top ICT firms are located in Ireland. They export €35 billion annually and provide employment for over 37,000 people. Pharmaceuticals employ 25,000 in their factories, and another 25,000 are employed in support industries. Half of all of Ireland's exports are pharmaceutical. These industries rely on water, and it is forecast that their needs will grow by 100 mld soon. We need a solution which will provide this additional water which is secure and sustainable. This project will achieve that.

Irish Water has been criticised for proposing this development when fixing leaks would save the additional water required for growth of these industries. However, it is important to develop 'headroom' to ensure that there are sufficient supplies of water to cope with unexpected demand. By 2050 an additional 215 mld will be required to supply the Dublin region. The population of Dublin and other settlements along the route of the pipeline are set to increase in population, and this will lead to an increase in demand. Irish Water have committed to reducing leaks in the aging water network to just 20%, but it would uneconomic to try to reduce that figure further. In any case, fixing leaks will not solve this problem of potential water shortages for key industries.

We also have to invest for future changes. As a Climate Change Scientist has said "Dublin is operating at the edge of its capacity, without even factoring in climate change". That is too close for comfort and the country has to get off the "knife edge", which Dublin's water supply has been on, according to a former environment minister.

Counter

This proposed project, were it allowed to take place, would destroy a 50 metre swathe of farmland along the 170 kilometres of the pipeline. This will impact upon 2,000 hectares of farmland, and threaten the livelihood of the farmers along the route. Farmers fear that a trench up to 6 metres deep will destroy the land along the route.

Taking such a large amount of water from the Shannon also might have negative economic consequences, the River Shannon Protection Alliance (RSPA) argues. Taking 4 cumecs of water from the Shannon is the equivalent of removing 2% of the flow of the river, and this may impact on the production of electricity at Ardnacrusha HEP station, particularly when river levels are low. There are also worries about the impact of removing 4 cubic metres every second on recreation and angling, as well as cruising and sailing on the Shannon.

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It must be remembered that this scheme will be paid for by the public in Ireland, and is the equivalent of a charge of €600 on every household. There is no protection against Irish Water becoming privately owned in the future.

There could be real challenges to the economy of the area around the river as navigation, angling and boat hire could all be hit by the scheme. Those who may benefit are in Dublin and surrounding areas, but this will just encourage an increase of foreign investment into this area, leaving the rest of the country behind.

There is also a question of how sustainable a scheme like this is. The yRSPA warn that there are examples elsewhere in the world where taking significant volumes of water from rivers and lakes "is continuing to cause, widespread social and economic losses and damage." They caution that, in some cases, this has led to these schemes being abandoned.

Irish Water are set to make a potential profit of €365 million each year from the sales of this water. They and the consumers in the Dublin region may benefit. However, RSPA have estimated that it would cost €621 million to abstract the planned 330 million litres of water each day from the Shannon. They also worry that demands will continue to rise, and there will be pressure to abstract more from the river in the future.

In any case there is no need for the pipeline. The water supply from the Shannon would not encourage the repair of the leaking water transport infrastructure which, at 48%, is as bad as cities in Mexico. Some European cities have reduced leakage rates to less than 6%. If this was achieved in Ireland, alongside other water saving strategies, the €1.2 billion could be saved, and spent on more worthwhile schemes.

NB Some candidates may discuss environmental factors in this section and this is acceptable, so long as they focus on the economic and social impacts of such changes to the environment. In B (ii), should the same environmental factors be revisited, candidates should not merely repeat the information, but should treat it in a fresh way.

Level 3 ([9]–[12])
Candidate states clearly the main benefits and the counterarguments. The discussion will be detailed and comprehensive. The account will have many of these characteristics:

- The points made will be consistently relevant and logically structured
- The ideas will demonstrate insight and a level of sophistication
- Clear understanding of all concepts will be demonstrated
- Use will be made of most of the relevant resource material, including that in diagrammatic form in the infographics and other resources, and understanding of the resources will be demonstrated – few significant points will be omitted
- Figures, where available and appropriate, will be used to good effect
- Ideas will be expressed clearly and effectively

Level 2 ([5]–[8])
Candidate will have fewer lines of thought or discussion may be limited. However, while ideas may lack depth and/or detail, they are

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still adequate. There may be a heavy imbalance between the two sides of the argument. The answer may concentrate on material from one source, e.g. the text, and not utilize the full range of resources available. The account may show deficiencies in the following ways:

- Understanding displayed but an over-reliance on verbatim quoting in places, even though appropriate
- Resource material used but some information not as well exploited as it could be
- Largely related to the question but some irrelevant material introduced
- Ideas not expressed particularly logically or clearly

Level 1 ([1]–[4])

- Simple understanding demonstrated but sketchily dealt with
- Excessive verbatim use of resources
- Some use made of the resource material but many relevant resources omitted
- Little or no structure or logic in the ordering of content [12]

(ii) The Environment (Discuss the potential environmental damage of the proposed development and the counterarguments.)

The damage to the land has an environmental as well as economic impact and 'Fight the Pipe', a campaign by farmers have argued that a potentially 6 metre deep trench, fracturing the rock, will impact negatively on the land above it, potentially damaging the environment. We are also told about the pipe 'microtunnelling' under seven rivers in its route. There is no detail provided on how this will work, but there is a realistic fear that river habitats may be damaged. The scale of the pipe should be recognised. This is around 2 metres in diameter which would allow a person to walk inside it. Burying such a pipe along 170 kilometres of countryside will be bound to have an impact.

The Shannon has the reputation as the longest stretch of clean water in the whole of Europe. This proposal threatens this, and the range of vulnerable areas along the river basin which are under protection. These include Natural Heritage Areas, SACs and SPAs. Some of these have wildlife which could be at risk if too much water is taken from the river to supply this pipeline. There is a fear of damage to the water quality of the river and to the ecology of the area. The RSPA argue that taking large volumes of water "… is continuing to cause, widespread ecological losses and damage".

The problems with the scheme may not be so apparent when there is a large flow of water into the Parteen Basin such as 100 cumecs. However, as 7D shows, flows into the Parteen Basin can be as low as 10 cumecs. To remove 4 cumecs in such a situation might have serious implications, and there would be the potential for environmental degradation during those periods. A further concern is the Birdhill Treatment Plant next to the Parteen Basin. There is some who worry about the disinfection by-products from such plants, particularly close to a sensitive river ecosystem.

In most water abstraction schemes water is taken from a river, used and then returned to the same river. This will not be the case here as 330 mld will be taken from the River Shannon, only to be returned when used to the sea off Dublin. The water will not have a chance of reuse and so is wasteful and potentially in conflict with EU regulations.

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There is also the concern that taking water from the Shannon will not encourage upgrading or the fixing of the leaks in the system, leading to more unsustainable water use. As Gerry Siney, the chairman of the RSPA has said “should they be allowed to introduce Shannon water into such a system, most of this water would be lost to the leaks also”.

Counter

It is accepted that there are environmental impacts from this project. However, this is the least damaging environmentally of all ten options considered.

The point where the abstraction takes place in the Parteen Basin has been carefully chosen to minimise the negative ecological impact upstream. Had it been taken from further upstream the impact would have been much greater. Taken, as it is, closer to the mouth of the Shannon, the impact is lessened.

The level of Lough Derg is regulated by the abstraction of water to the HEP station at Ardnacrusha. As 4 cumecs will be taken for the pipeline (only 2% of the average flow of the river), there will be a small reduction of the amount of water going to the HEP station to compensate. In this way, the level of Lough Derg will be preserved and the environment in and around the Lough will not be affected.

Indeed the partnerships between Inland Fisheries Ireland and Irish Water will allow improvements in the fisheries in the Shannon, and also in the smaller rivers and streams along the 170 kilometre route of the pipeline.

The developers will also support the development of cycle paths, greenways, walks and other environmental improvements along the route of the pipeline.

NB Some candidates may discuss economic factors in this section and this is acceptable, so long as they focus on the environmental impact and its consequent cost. In B (i), should the same economic factors have been covered, candidates should not merely repeat the information, but should treat it in a fresh way.

Level 3 ([7]–[8])
Candidate states clearly the main changes and the counterarguments, although there may be less to say in the environmental counterargument. The discussion will be as detailed and comprehensive as the resources allow. The account will have many of these characteristics:

- The points made will be consistently relevant and logically structured
- The ideas will demonstrate insight and a level of sophistication
- Clear understanding of all concepts will be demonstrated
- Use will be made of most of the relevant resource material, including that in diagrammatic form in the resources – few significant points will be omitted
- Figures, where available and appropriate, will be used to good effect
- Ideas will be expressed clearly and effectively

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Level 2 ([4]–[6])
Candidate will have fewer lines of thought or discussion may be limited. However, while ideas may lack depth and/or detail, they are still adequate. There may be a heavy imbalance between the two sides of the argument. The account may show deficiencies in the following ways:

- Understanding displayed but an over-reliance on verbatim quoting in places, even though appropriate
- Resource material used but some information not as well exploited as it could be
- Largely related to the question but some irrelevant material introduced
- Ideas not expressed particularly logically or clearly

Level 1 ([1]–[3])

- Simple understanding demonstrated but sketchily dealt with
- Excessive verbatim use of resources
- Some use made of the resource material but many relevant resources omitted
- Little or no structure or logic in the ordering of content [8]

C. Decision (State clearly your decision and justify it on the basis of the greater overall benefits)

The recommendation may overlap with some of the points made in B in relation to the potential social and economic or environmental impact of the pipeline. However, the emphasis here has to be on the *greater overall benefits* of developing or not developing the pipeline and the contrary view. In this section, for example, candidates can weigh up the relative merits of arguable damage to the environment with possible economic development and employment for local people.
There is no mark for stating a decision alone without a justification.

Level 3 ([8]–[10])
Candidate states clearly a decision. A range of reasons are provided in justification. The account will have many of the following:

- There is evidence that the arguments of both sides are being balanced, one against the other
- Links are made between diverse aspects of resource material, not possible in Section B
- Points are consistently relevant and logically structured
- There is a clear grasp of the concepts used

Level 2 ([4]–[7])
There are fewer lines of thought or discussion, but what there is is relevant and correct or supportable in what is argued. There may be deficiencies such as:

- Too much verbatim quoting or overuse of quotations in full
- Important sections of resource material not utilised
- Irrelevant material introduced
- Ideas not expressed particularly logically or clearly
- Understanding of concepts not always clearly demonstrated

Level 1 ([1]–[3])

- Few lines of thought and sketchy in detail
- Large gaps in the use of resource material
- Little or no structure or logic in the ordering of the concepts
- There may be excessive verbatim use of resources [10]

		AVAILABLE MARKS
Format		
Clear format headings **using the headings provided** throughout [1]		
Clear subheadings **using the subheadings provided** in Section B [1]	[2]	
Role		
Role of Dr David Mark, Inspector for An Bord Pleanála, adopted [1]		
Role maintained [1]	[2]	
Graph		
Reference in report [1]		
Appropriateness of the technique used [1]		
Accuracy of the data presented [3]		
Conventions (key, labelled axes, title) [3]	[8]	50
	Total	**110**