New Specification

Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2017

Geography

Assessment Unit AS 1

assessing

Physical Geography

[SGG11]

TUESDAY 16 MAY, AFTERNOON

MARK SCHEME

MARK SCHEMES

Foreword

Introduction

Mark Schemes are published to assist teachers and students in their 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 what 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

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1 (a) Responses should provide a **description** of the hydrograph as well as **explanation** in relation to **two** of the drainage basin characteristics illustrated on **Resource 1A**.

Description

The hydrograph could be described as "**flashy**" with typical "flash flood" characteristics. After a short approach segment, there is an obvious **steep rising limb** as the river level rose from approximately 12.5 cumecs at 4 pm on the 16th January to over 26 cumecs (a **high peak discharge**) at 4 am on the 18th January. The **recession limb** declines more gradually. A **lag time** of approximately 24 hours is evident.

Explanation

As outlined in **Resource 1A**, there are many physical and human factors which may explain this hydrological response.

A – Geology

The solid bedrock (predominantly Wealden Clays and Greensand) are of low permeability. The rock type controls the percolation and storage capacity of the bedrock and obviously the height of the water table. These impermeable rocks reduce the potential for the more gradual baseflow transfer. Impeded percolation often results in saturated soils which reduce infiltration. Therefore a larger proportion of the precipitation will travel to the river more rapidly as overland flow (surface runoff) which produces the typical flash flood characteristics.

B – Drainage Basin Shape

The Upper Mole section of the drainage basin occupies the larger circular portion of the drainage basin. Therefore, the tributaries transfer water from a wide circular shaped catchment. In contrast to a more elongated basin, tributaries are more equidistant from the gauging station and therefore water reaches the river, from the extremes of the basin, at an approximately similar time period. Therefore a large volume of water enters the river which produces typical flash flood characteristics.

C – Relief

Steeper slopes in the upper watershed zone encourage water transfer via surface runoff due to the enhanced "gravitational pull" downhill which reduces the potential for infiltration and more gradual sub-surface water transfers. Increased surface runoff produces typical flash flood hydrograph characteristics. The higher catchment elevation outlined in **Resource 1A** may be sufficient to cause local enhancement of precipitation as a result of orographic uplift.

D – Urbanisation

Urbanisation of any catchment will inevitably alter the runoff regime. In this example the expansion of towns such as Crawley and the airport terminals at Gatwick will be associated with the expansion of impermeable surfaces within the drainage basin with a corresponding loss of vegetation and a loss of more permeable surfaces. The resultant decrease in interception,

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transpiration and infiltration facilitates the transfer of a larger proportion of precipitation as surface runoff. The rate and volume of water transfer is exacerbated by the installation of gutters and storm drains. As the storage capacity of the drainage basin is reduced and surface runoff increased, typical flash flood characteristics can be explained on the hydrograph.

E – Soil Conditions

If the soils of the drainage basin are already saturated (antecedent rainfall) then their infiltration capacity is greatly reduced. As infiltration is impeded, a large volume of precipitation is transferred rapidly to the river as a result of surface runoff. Rising water tables are also associated with saturated soils, which frequently result in water logging and reduced infiltration. Soil saturation reduces the ability of the drainage basin to increase its storage capacity and exacerbates the hydrological effect of the storm event.

The breakdown is as follows:

Description

Award up to [2] for a **description** of the hydrograph. For full marks there should be at least two "flash flood" hydrograph characteristics identified and at least two accurate values quoted.

Explanation 2 × [3]

Award [3] marks for a coherent and detailed explanation which displays a clear understanding of the factor selected. Appropriate geographical terminology is used.

Award [1–2] marks for a more simplistic, or less thorough, explanation which may not make full use of specialist terminology. [8]

(b) **Resource 1B** illustrates the pattern of sediment exchange throughout the course of the Difficult Run River. Erosion is evident throughout the course, but was generally greatest in the headwater sites. Sediment loss reached a maximum of 450 kg/m/year at Site 2, 4.3 km from the source of the river. Deposition is also apparent throughout the river but generally increases downstream. A maximum gain of approximately 1,400 kg/m/year was evident at Site 5, 20.7 km from the source of the river.

Erosion of the channel through the processes of abrasion, hydraulic action and solution generates the production of sediment from the river banks. The type of erosion, lateral and/or vertical, depends on the energy or discharge of the river. Floodplains are areas of low relief formed by deposition in low energy conditions. There are two types of sediment aggradation/deposition which form the floodplain of the river:

Lateral Deposition: The alluvium is a mixture of sand and gravel, eroded from the outside of the meander and built up from deposition on the inside of the bend as the meander migrates downstream over time.
Horizontal Deposition: In addition floodplains are built up from horizontal layers of sediment deposited by the river during the flooding process (often resulting in raised banks or levees).

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The mark breakdown is as follows:

Description

Award up to [2] for a **description** of the pattern of sediment exchange. For full marks, reference should be made to both erosion and deposition with values quoted. Award [1] for recognition of both general trends but no values given.

Explanation

Award up to [2] marks for an explanation of erosion in the release/production of sediment from the river channel.

Award up to [3] marks for an explanation of how the floodplain is formed as a result of sediment deposition. For full marks candidates must recognise the importance of both lateral and horizontal accretion. [7] 15

2 (a) (i) Climatic Climax (Community) [1]

(ii) Pioneer species are hardy, resilient individuals able to tolerate extreme or hostile conditions. They have a variety of adaptations which enable them to survive in exposed sites with unfavourable soil conditions as well as a harsh micro-climate. In **Resource 2A** it is evident that mosses and lichens can colonise the site exposed by glacial retreat which is characterised by shallow soils of 5.2 cm, low nitrogen content and low levels of litter (1.5g/m^2/year) which is indicative of a low soil nutrient status.

Award up to [3] for an answer which recognises the specialist characteristics of the pioneer species as well as hostile site conditions. For full marks there should be relevant and explicit evidence extracted from **Resource 2A**. Maximum [2] if no values are quoted from Resource 2A. [3]

(iii) Soils are highly modified throughout succession as a result of autogenic processes. Soil depth increases as a result of biological weathering. In Glacier Bay it has increased to 15.1 cm after 200 years, partly as a result of plant root growth. Soil fertility as exemplified by the nitrogen content, dramatically increased from 3.8g/m^2 to 53.3g/m^2 after 200 years. Nutrient cycling becomes more active and bases are released into the soil from the decomposition of litter. Litter fall has increased from 1.5g/m^2/year to 261g/m^2/year over the time period of succession. The subsequent production of humus increases the soil's moisture retention capacity. The soil PH becomes more acidic (3.6) as a result of the humic acids released from the decomposition process. In addition, soils become darker and more mature with progressive seral communities and the more extensive root systems from the climax spruce forest stabilise the soil, reducing its susceptibility to erosion.

Level 3 [5]
A detailed explanation of soil modification is presented using specialist terminology. The answer is well supported with appropriate data from **Resource 2A**.

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Level 2 ([3]–[4])
The candidate produces an adequate but less detailed explanation of the autogenic processes. There may be fewer aspects of soil modification outlined and resource reference may be limited to trends only at the lower mark boundary.

Level 1 ([1]–[2])
The candidate produces a more limited or incomplete answer. Few aspects of soil modification may be identified and the explanation of the processes may lack development. Candidates who take only one characteristic will be at this level. [5]

(b) (i) Soils in the Tundra are developed on permafrost. A variety of characteristics of Tundra soils in summer are provided for selection.

Shallow: Although the surface of the soil thaws out in summer, it is only to a depth of a few centimetres. The existence of the sub-surface permafrost layer reduces soil depth. Restricted biological activity, in terms of root growth, animal burrowing and decomposition of organic matter restricts soil development and depth.
Infertility: The acidic, waterlogged topsoil in summer and permanently frozen soils in winter restrict plant diversity and productivity. Therefore, the lack of litter and decomposition restricts the production of humus and the release of nutrients.
Peaty: There is an accumulation of organic matter due to the low temperatures and the high level of acidity. The acidity and lack of oxygen in waterlogged conditions restricts the development of soil micro-organisms and thus the efficiency of the decomposition process. This partially decomposed organic matter produces a layer of peat.
Waterlogged: Soils are generally waterlogged in summer as the sub-surface permafrost layer impedes the downward percolation of the melt water. The cool temperatures and hence low evaporation rates, reduce moisture loss to the atmosphere. In addition, higher summer precipitation totals can exacerbate the high soil moisture content.
Acidic: Acidity results from an accumulation and concentration of hydrogen ions in the soil. Permanent water logging in the summer and the existence of a high water table and a thick layer of peat (undecomposed organic matter) results in a high level of acidity. In addition, acidic bedrock can contribute to the resultant soil PH value. Some of the lichens which colonise the soils in summer secrete acid, influencing PH levels.

Award up to [2] for a logical, well informed explanation of the selected topsoil characteristic. [2]

(ii) The images present evidence of the **actual** impact of permafrost thaw. Housing subsidence and damage to infrastructure (the highway) is evident. Thus financial projections indicate that an additional cost of up to $6.1 billion will be required to update infrastructure between 2006 and 2030 as a result of climate change.
Thawing of permafrost, as a result of increased temperatures/climate change, alters the stability of the active layer of the soil with a potentially adverse impact on building foundations and support structures. The loss of mechanical strength results in subsidence and costly damage to infrastructure.

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Mark Breakdown as follows:
Description [2]

- Description of **actual** evidence displayed in images.
- Description of **potential** financial impact displayed in the bar chart.

Explanation [2]
Award up to [2] marks for an understanding of the cause of infrastructural damage and cost in relation to permafrost thaw and subsequent subsidence. [4]

15

3 (a) (i) A – Polar Cell
B – Ferrel Cell
2 × [1] [2]

(ii) **X** represents cyclonic/frontal rainfall

This type of rainfall is common in the mid-latitudes where a mass of warm air meets a mass of cold Polar air along the Polar front. The cold air undercuts the warm air forcing it to rise. The subsequent uplift results in cooling and an increase in Relative Humidity. Condensation occurs at dew point temperature, releasing latent heat and allowing further uplift and cooling. The formation of clouds results in cyclonic rainfall.

Y represents convectional rainfall

This type of rainfall is common in equatorial regions, or over the summer months in the U.K. Incoming short wave radiation reaches the ground which is converted into long wave heat energy. This heat energy heats the air which then rises (thermal uplift). As the air rises, it cools and Relative Humidity increases. Condensation occurs at dew point temperature. The release of latent heat produces further uplift, cooling and condensation, producing towering cumulonimbus clouds which produce heavy convectional rainfall.

Award [1] for correct identification of selected rainfall type (x/y). Award [1] for clarification of air uplift mechanism. Award up to [2] for rainfall formation processes with relevant terminology. [4]

(iii) The Polar Front jet stream is illustrated on **Resource 3**. Candidates should recognise the following locational characteristics:

- Altitude – approximately 10km
- Latitude – approximately 60°N
- Situated at the Tropopause, between the troposphere and the stratosphere
- Located between the Polar and Ferrel Cells

The weather systems experienced in mid-latitude environments are controlled by the orientation of the Polar Jet stream. It is a fast moving strip of air high up in the atmosphere, moving from west to east in a series of ridges and troughs. It steers weather systems towards us from the Atlantic and the precise location of the jet can vary on a seasonal basis.

When the upper jet air moves out of a trough towards the Polar latitudes, it accelerates and diverges. Air is drawn up, in an

anticlockwise spiralling motion, from the lower atmosphere causing a low pressure depression at the earth's surface.

By contrast, when air flow in the upper jet approaches a trough and flows towards the lower latitudes, it tends to slow down and converge causing air molecules to descend clockwise to the ground surface producing an anticyclone (high pressure centre).

Mark Breakdown

Location [2]

Award 2 × [1] for each precise locational statement based on **Resource 3**.

Importance [4]

Award up to [2] for an explanation of the importance of the jet stream for the formation of depressions. Award up to [2] for an explanation of the jet stream and for the formation of anticyclones [6]

(b) Temperatures decrease with altitude, at a rate of 1°C for every 100 m. This is because pressure, which is related to the number of molecules per unit volume of air, decreases with altitude. When incoming short wave radiation is absorbed by the earth's surface it is radiated back to the atmosphere as heat (long wave radiation). Essentially the greenhouse effect occurs as most heat energy can be absorbed closer to the ground surface where a high density of molecules exist.

Award [1] for the trend (how). Award up to [2] for the explanation presented as well as the inclusion of theoretical concepts and geographical terminology [3]

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15
45

Section A

Section B

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4 Channelisation is a form of hard engineering river management. It is a deliberate attempt to alter the geometry of the natural river channel. There are several reasons why channelisation may be necessary. Channelisation can provide erosion control to prevent sediment loss from the river bed or banks. It can provide a straighter, deeper channel to assist navigation or, more commonly, it is essential to assist channel capacity to regulate water flow and prevent flooding. Furthermore, channelisation may be introduced as part of wetland reclamation schemes or to facilitate the construction of bridges or highways. There are many forms of channelisation.
Re-alignment: This involves the removal of meanders and the straightening of the river channel. This strategy has many advantages, as well as significant ecological, financial and environmental disadvantages.
Re-sectioning: This essentially involves channel enlargement through widening and deepening. Similarly, many advantages exist but this engineering solution creates a myriad of problems, often in downstream locations.
Dredging: It is the removal of sediment and silt which has accumulated on the river bed, increasing the capacity of the river channel to transport water and reduce flooding. Like all hard engineering management methods, it is a topic of contentious debate as there are many advantages and disadvantages.
Award [0] for a response not worthy of credit.

Level 3 ([11]–[15])
The candidate competently addresses all aspects of the question providing detail on the reasons why channelisation may be introduced, accurate knowledge of the distinct strategies and appropriate locational references. Evaluative comments are insightful and well informed. Quality of written communication is excellent.

Level 2 ([6]–[10])
Although good understanding of channelisation and river management methods is evident, the answer may lack detail. Place references may be neglected and evaluative comments may be less insightful. Specialist terminology may be less impressive. Quality of written communication is good.

Level 1 ([1]–[5])
The candidate provides a more simplistic answer which may fail to address all aspects of the question. At this level, description may replace evaluation. There may be some inaccuracy and fewer specialist terms. Quality of written communication is basic. [15]

5 The details of the answer will depend on the small scale case study selected. This may be a named woodland, lake, peat land, sand dune system, etc. The locational context of the study should be outlined in the answer. Candidates need to address how their chosen ecosystem functions through energy flow and nutrient cycling.
Energy Flow will require a knowledge of energy fixation, transfer and loss with named species examples.
Nutrient Cycling demands a knowledge of nutrient transfers between the Biomass, Litter and Soil stores, as well as a knowledge of the inputs and losses to the system.
Maximum Level 1 if the answer has no case study.
Award [0] for a response not worthy of credit.

Level 3 ([11]–[15])
The candidate presents a balanced, well written answer which includes accuracy and detailed theoretical knowledge as well as impressive case study specifics. There is a confident use of specialist terminology. Quality of written communication is excellent.

Level 2 ([6]–[10])
The answer may lack balance or provide a more generalised discussion of both energy flow and nutrient cycling. There may be some gaps in detail but a named case study remains an essential component of the answer. Some specialist terminology is used with relevancy. Quality of written communication is good.

Level 1 ([1]–[5])
The candidate provides a more limited understanding of ecosystem functioning. There may be significant content omitted and some inaccuracies identified. Fewer specialist terms may be included and the level of written communication may be basic. [15]

6 A specific case study event is requested and the protective strategies described will depend on the spatial context of the study. The question requires both description of the protective measures adopted, as well as an evaluation of their effectiveness. Protective measures may include meteorological forecasting, the use of geo-stationary satellites and computer modelling, public warning systems, capacity construction methods, coastal engineering schemes, evacuation planning, hazard mapping (vulnerability analysis), education programmes, etc. Evaluative comments may relate to both positive and negative aspects of their implementation. Recovery programmes, or post-hurricane management strategies, are not relevant within the context of the question.
Award [0] for a response not worthy of credit.

Level 3 ([11]–[15])
The candidate clearly provides a case study focus and competently describes a range of protective measures implemented. Evaluative comments, in relation to people and property, are relevant and insightful. The answer is well written with the inclusion of specialist terminology and case study details. Quality of written communication is excellent.

Level 2 ([6]–[10])
The candidate provides a less detailed description of protective measures with a less thorough evaluation of their effectiveness for people and property. Case study references and specialist terminology may be less evident. Quality of written communication is good.

Level 1 ([1]–[5])
The answer may lack a case study focus and thus descriptive comments may be more generalised and theoretical. A narrow range of protective measures may be outlined and evaluation may be largely neglected. The quality of written communication may be basic. [15]

Section B **30**

Total **75**

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