Cambridge Assessment International Education

Cambridge International AS & A Level

GEOGRAPHY **9696/11**

Paper 1 Core Physical Geography **May/June 2023**

MARK SCHEME

Maximum Mark: 60

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1: Marks must be awarded in line with: • the specific content of the mark scheme or the generic level descriptors for the question • the specific skills defined in the mark scheme or in the generic level descriptors for the question • the standard of response required by a candidate as exemplified by the standardisation scripts.
GENERIC MARKING PRINCIPLE 2: Marks awarded are always **whole marks** (not half marks, or other fractions).
GENERIC MARKING PRINCIPLE 3: Marks must be awarded **positively**: • marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate • marks are awarded when candidates clearly demonstrate what they know and can do • marks are not deducted for errors • marks are not deducted for omissions • answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.
GENERIC MARKING PRINCIPLE 4: Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.
GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

AS Level Geography 9696 (Paper 1 and Paper 2) specific marking instructions

Examiners must use the following annotations:

Annotation	Meaning	Use
✓	Correct point	Point-marked questions only: Section A, Section B part (a)
✗	Incorrect	Point-marked questions only: Section A, Section B part (a)
L4	Level 4	Levels-marked questions only: Section B part (c)
L3	Level 3	Levels-marked questions only: Section B parts (b) and (c)
L2	Level 2	Levels-marked questions only: Section B parts (b) and (c)
L1	Level 1	Levels-marked questions only: Section B parts (b) and (c)
0	Level 0 – No creditable response	Levels-marked questions only: Section B parts (b) and (c)
Highlight	Creditworthy part of an extended response	Levels-marked questions only: Section B parts (b) and (c)
EVAL	Evaluative point	Levels-marked questions only: Section B part (c)
^	Omission or further development/detail needed to gain credit	All questions
?	Unclear or validity is doubted	All questions
DEV	Developed point	All questions
EG	Appropriate example or case study given	All questions
IRRL	Irrelevant	All questions
NAQ	Material that does not answer the question	All questions
	Highlighting a significant part of an extended response – to be used with another annotation e.g. IRRL or EVAL	Levels-marked questions only: Section B parts (b) and (c)

SEEN	1. Diagram or essay plan has been seen but no specific credit given 2. Additional page has been checked	1. Any diagrams or essay plans 2. All blank pages in the provided generic answer booklet and/or extension answer booklet(s).
R	Rubric error	Optional questions only (place at start of question not being credited): Section B (Candidates answer one question)

Section A

Answer **all** questions in this section. All questions are worth 10 marks.

Hydrology and fluvial geomorphology

Question	Answer	Marks
1(a)(i)	**Fig. 1.1 shows the velocity of flow that erodes, transports and deposits sediment in a river channel.** **Name the diagram shown in Fig. 1.1.** Hjulström	**1**
1(a)(ii)	**State the size of sediment at the lowest erosion velocity shown in Fig. 1.1.** 0.11 to 0.15 mm (units necessary)	**1**
1(b)	**Use Fig. 1.1 to explain why the minimum velocity needed for sediment erosion varies.** The differences seen for sediment smaller than sand, greater velocities are needed for sediment to erode. The reason for this is the cohesive nature of clay. For sediment larger than sand, there is a clear increase in velocity needed to erode the sediment, due to their weight. Simple descriptions based on the Figure – **max. 2.** Credit use of Fig. 1.1. **Max. 3** if no reference to Fig. 1.1.	**4**

Question	Answer	Marks
1(c)	**Explain <u>two</u> reasons for the variation of deposition along a river channel.** Main reasons relate to velocity, discharge and sediment load. Reasons include: • Drop in velocity on entering a lake/sea, perhaps flocculation • Amount of friction, higher in upper course of river, greater turbulence thus very variable local velocity, step-pool sequences • Hydraulic radius increases downstream therefore less friction and less deposition • Deposition behind obstacles • Entering riffles • Effect of meander shape, usually in middle/lower zone of rivers e.g. lower velocity on inside bends e.g. point bars • Change in gradient downstream with effect on velocity • Change in sediment supply such as from tributaries • Decreased sediment size downstream as a result of attrition means less likely to be deposited **Max. 3** if only one reason given. **1 mark** for reason, **1 mark** for each development(s).	**4**

Atmosphere and weather

Question	Answer	Marks
2(a)	**Fig. 2.1 is a photograph which shows the state of water on two different surfaces on a winter day, in England, UK.** **Describe the state of water on the two different surfaces shown in Fig. 2.1.** • Water on the pavement or some equivalent/black/to the left is liquid • Water on the vegetation/right is frozen (ice/snow)/in solid state **1 mark** for each identification.	**2**
2(b)	**Suggest reasons for the difference in the state of water on the two different surfaces shown in Fig. 2.1.** Main reason is different surface temperatures, the result of: • Differences in albedo and effect on absorption of shortwave radiation • Different rates of heat conduction • Differences in energy absorbed/released • Antecedent moisture conditions for the grass • Surface characteristics e.g. vegetation vs pavement • Anthropogenic influence e.g. walking/trampling preferentially on the pavement/slate **1 mark** for each point, **2 marks** for each developed point, up to the maximum.	**4**
2(c)	**Explain why there can be a difference between the state of water during the daytime and night-time.** The six components of the daytime budget and the four components of the night-time budget can be discussed here with influence on radiation and heat transfer. Explanation must be related to the state of water i.e. liquid (water, dew), solid (ice/snow), gaseous (water vapour). • Influence of insolation (short-wave radiation) only during day, therefore greater temperature • Greater evaporation during the day thus less surface water but possibly greater water vapour • Ground heated more through process of conduction during day • Change of state by latent heat transfer • Radiative cooling at night possibly leading to formation of dew **1 mark** for each point, **2 marks** for each developed point, up to the maximum. Credit use of diagrams if related to state of water.	**4**

Rocks and weathering

Question	Answer	Marks
3(a)(i)	**Fig. 3.1 is a map of Lochnagar, South Island, New Zealand.** **Give an estimate for the area of the landslide shown in Fig. 3.1.** 2.5 – 3.0 km^2. Unit required for mark.	1
3(a)(ii)	**State the direction of movement of the landslide shown in Fig. 3.1.** South-west (from north-east to south-west)	1
3(b)	**Use evidence from Fig. 3.1 to suggest reasons for slope instability in this area.** Relates to entire area and not just the landslide. • Very close contours indicate steep slopes e.g. GR 5352 and gravity effect • High elevation suggests active physical weathering of the rock surfaces with perhaps rockfalls • High elevation suggests high precipitation amounts • Lack of vegetation on the slopes therefore possible instability • Many springs and streams in the area suggest high rainfall, which can lead to loss of shear strength, increased pore water pressure/lack of cohesion and add weight to material on the slopes • Key indicates surface material is rough scree or similar which will be poorly consolidated and relatively easy to move if a mass movement is triggered • Possible snow melt from high mountains • Many deeply incised small streams which could indicate potential instability • Possible undercutting by rivers • Vehicle tracks might cause instability **1 mark** for each point, **2 marks** for each developed point, up to the maximum. If no explicit reference to evidence from the map – **max. 3**.	4

Question	Answer	Marks
3(c)	**Explain how a mass movement can affect the slope of an area.** The effect of the mass movement, which should be related to specific types of mass movement for any development point, can include: • An increase in angle as material moves downslope, leading to oversteepening and a scar • A decrease in angle at the base of a slope as the material builds up as a toe e.g. in a slip such as a rotational slide, or lobe as in mudflows • Debris accumulation at slope base such as scree/talus • Exposed rock face – potential for further mass movement • Destruction of vegetation • Soil creep terracettes, solifluction lobes, blockfields • Decreasing slope height and increasing slope length • Ongoing instability **1 mark** for each point, **2 marks** for each developed point, up to the maximum.	**4**

Section B

Answer **one** question from this section. All questions are worth 30 marks.

Hydrology and fluvial geomorphology

Question	Answer	Marks
4(a)(i)	**Briefly explain why precipitation may not always reach a river channel.** Precipitation may: • Be intercepted by vegetation and then uptake by plant roots • Be lost by evapotranspiration from vegetation • Be used by humans • Evaporate from impermeable surfaces • Permeate through bedrock and enter ground water and eventually an aquifer • Be stored in a lake • Fall as snow and become consolidated as ice **1 mark** for each explanatory point.	**3**
4(a)(ii)	**Outline <u>two</u> factors which influence the formation of a braided channel.** Factors could include: • Variable discharge e.g. seasonal/daily variations in discharge by glacial/snow melt or seasonal discharge in semi-arid areas • High sediment load enabling deposition as eyots in times of low discharge • Multiple channels created in times of low flow • Easily erodible riverbanks leading to wide, shallow channels • Stabilisation of eyots with vegetation in times of low discharge There should be some discussion of the nature of braided channels (eyots, vegetated or unvegetated, multiple channels) and therefore the factors that influence their formation **2 marks** for outline of each factor to the maximum.	**4**

Question	Answer	Marks
4(b)	**Describe and explain how soft engineering and hard engineering can be used to prevent river floods.** Soft engineering methods include: • Flood plain management, land zoning and restriction of infrastructure • Wetland and riverbank conservation and restoration, maintaining natural riverbanks • Reforestation in upper drainage basin to reduce runoff into channels • Returning floodplains and rivers to their natural course e.g. River Kissimmee, Florida Hard engineering methods include: • Dams and reservoirs to control discharge • River straightening to speed up flow • Embankment/levee construction to increase channel capacity • Diversion spillways • Raise buildings above flood levels • Dredging to increase the volume of water that can be carried • Flood relief channels/lakes to divert water from sensitive areas Need both description and explanation. Award marks based on the quality of explanation and breadth of the response using the marking levels below. **Level 3 (6–8)** Response clearly describes and explains how soft engineering and hard engineering can be used to prevent river floods. Response is well founded in detailed knowledge and strong conceptual understanding of the topic. Examples used are appropriate and integrated effectively into the response. **Level 2 (3–5)** Response describes and explains how soft engineering and/or hard engineering can be used to prevent river floods. Response develops on a largely secure base of knowledge and understanding. Examples may lack detail or development. Maximum 4 if only soft or hard engineering. **Level 1 (1–2)** Response describes how soft engineering and/or hard engineering can be used to prevent river floods. Knowledge is basic and understanding may be inaccurate. Examples are in name only or lacking entirely. **Level 0 (0)** No creditable response.	**8**

Question	Answer	Marks
4(c)	**‘Urbanisation always results in an increase in channel flow.’** **With the aid of examples, how far do you agree?** Candidates are free to develop their own approach to the question and responses will vary depending on the approach chosen. Whichever approach is chosen, essays which address the question and support their argument with relevant examples will be credited. There may be detailed consideration of a case study/one or more examples, or a broadly conceived response, drawing on several examples to illustrate the factors involved. Main reasons for increased amounts of flow are: • Impermeable surfaces in urban areas, thus greater runoff • Channelled to rivers by drains etc. • Deforestation/land-use change to develop urban areas • Possible increase in precipitation as a result of urban heat island effect Reasons for possible increased velocity: • Channelisation Main reasons for a possible decrease in flow: • Dams/reservoirs for urban supply, electricity etc. • Diversion of water into canals • Channelled directly into sea such as Thames Tideway Tunnel • There might be discussion of Sustainable Urban Drainage (SUDs) There should be some evaluation. The main conclusion could be that urbanisation always leads to an increase in channel flow but that the increase can be lessened. An awareness that modifications can result in either increase or decrease in channel flow. For example, urbanisation changes result in permeable to impermeable surfaces with increased runoff, leading to increased channel flow. However increased demand for water supply, and activities such as water extraction, may result in a decrease in channel flow. Award marks based on the quality of the response using the marking levels below. **Level 4 (12–15)** Response thoroughly discusses modifications to channel flows by urbanisation and considers whether it always results in an increase in channel flow. Examples used are appropriate and integrated effectively into the response. Response is well founded in detailed knowledge and strong conceptual understanding of the topic.	**15**

Question	Answer	Marks
4(c)	**Level 3 (8–11)** Response discusses modifications to channel flows by urbanisation and considers whether it always results in an increase in channel flow but may be unbalanced. Examples may lack detail or development. Response develops on a largely secure base of knowledge and understanding. **Level 2 (4–7)** Response shows general knowledge and understanding of modifications to channel flows by urbanisation and considers whether it always results in an increase in channel flow. Response is mainly descriptive or explanatory with limited use of examples and understanding of the topic may be partial or inaccurate. Some concluding remarks. General responses without the use of example(s) will not get above the middle of Level 2 (6 marks). **Level 1 (1–3)** Response may broadly discuss modifications to channel flows by urbanisation and considers whether it always results in an increase in channel flow but does not address the question and does not come to a convincing conclusion. Response is descriptive, knowledge is basic and understanding is poor. **Level 0 (0)** No creditable response.	

Atmosphere and weather

Question	Answer	Marks
5(a)(i)	**Define the atmospheric terms *latent heat transfer* and *dew.*** Latent heat transfer is that heat which is transferred during a change in state (1) e.g. water to water vapour by evaporation or water vapour to water by condensation (1). Dew is water in the form of droplets/direct precipitation on a surface (1), caused by condensation or cooling (1).	4
5(a)(ii)	**Describe how the orographic uplift of air may result in precipitation.** The main points are: • Moist air forced to rise by a mountain barrier • Drop in temperature leads to cooling to dew point • Condensation leads to water droplets • Water droplets may coalesce becoming heavy enough to fall as precipitation A diagram showing the passage of air over a mountainous region and the correct placement of rainfall is worthy of credit. **1 mark** for each relevant point.	3

Question	Answer	Marks
5(b)	**Describe and explain the formation of an urban heat island.** Urban heat island describes the situation where an urban area experiences a significantly different microclimate to surrounding rural areas. In general, they have higher temperatures, greater cloud cover, potentially more precipitation and possibly more gusty wind conditions. Most pronounced at night and during calm clear weather (anticyclonic conditions). An urban heat island is where the urban area is consistently warmer than the surrounding rural area. This is formed because of the fabric of the urban area and the activities that take place there e.g. tarmac and concrete buildings with a lower albedo absorbing and retaining heat, and releasing that heat at night as longwave radiation. Tall buildings restricting cooling effect of wind. Domestic and industrial heat generation, atmospheric pollutants and dust particles from vehicles and other activities (pollution dome), lower evapotranspiration rates as there are fewer areas of vegetation thus reducing latent heat transfer. Credit use of annotated diagram(s). Award marks based on the quality of explanation and breadth of the response using the marking levels below. **Level 3 (6–8)** Response clearly describes and explains the formation of an urban heat island. Response is well founded in detailed knowledge and strong conceptual understanding of the topic. Examples used are appropriate and integrated effectively into the response. **Level 2 (3–5)** Response describes and explains the formation of an urban heat island. Response develops on a largely secure base of knowledge and understanding. Examples may lack detail or development. **Level 1 (1–2)** Response describes and/or explains the formation of an urban heat island. Knowledge is basic and understanding may be inaccurate. Examples are in name only or lacking entirely. **Level 0 (0)** No creditable response.	**8**

Question	Answer	Marks
5(c)	**With the aid of examples, assess the extent to which ocean currents are the main energy transfer within the global energy budget.** Candidates are free to develop their own approach to the question and responses will vary depending on the approach chosen. Whichever approach is chosen, essays which address the question and support their argument with relevant examples will be credited. There may be detailed consideration of a case study/one or more examples, or a broadly conceived response, drawing on several examples to illustrate the factors involved. Responses should weigh up the effect of ocean currents as a transfer of excess energy, but then also consider transfers such as wind. It is estimated that currents and ocean gyres transfer about 20% of the global energy. The effect of ocean currents would need to be considered, noting that it is also dependent on whether these currents are warm or cold. The argument could be made that ocean currents, such as the gulf stream, are more notable during the winter, and thus the answer may conclude that it is dependent on factors such as seasons and locations. They also may classify transfers as being horizontal or vertical. Most global energy is transferred by winds. The candidate may support the statement by referring to sub-tropical high-pressure belts and trade winds as well as mid-latitude and polar easterlies. Detailed discussion on concepts such as air masses may be given. Discussion of jet streams and Rossby waves is also relevant. A consideration of factors such as large continental areas or latitude as an influence on pressure and wind systems may also be relevant. Award marks based on the quality of the response using the marking levels below. **Level 4 (12–15)** Response thoroughly discusses the extent to which ocean currents are the main energy transfer within the global energy budget. Examples used are appropriate and integrated effectively into the response. Response is well founded in detailed knowledge and strong conceptual understanding of the topic. **Level 3 (8–11)** Response discusses the extent to which ocean currents are the main energy transfer within the global energy budget but may be unbalanced. Examples may lack detail or development. Response develops on a largely secure base of knowledge and understanding. **Level 2 (4–7)** Response shows general knowledge and understanding of the extent to which ocean currents are the main energy transfer within the global energy budget. Response is mainly descriptive or explanatory with limited use of examples and understanding of the topic may be partial or inaccurate. Some concluding remarks. General responses without the use of example(s) will not get above the middle of Level 2 (6 marks).	**15**

Question	Answer	Marks
5(c)	**Level 1 (1–3)** Response may broadly discuss ocean currents within the global energy budget but does not address the question and does not come to a convincing conclusion. Response is descriptive, knowledge is basic and understanding is poor. **Level 0 (0)** No creditable response.	

Rocks and weathering

Question	Answer	Marks
6(a)(i)	**Define the terms *rainsplash* and *rills.*** Rainsplash is when precipitation hits bare soil (1) which dislodges soil particles (1). Rills are (small, shallow) channels (1) cut by water flowing over soils (1).	4
6(a)(ii)	**Briefly explain how afforestation can reduce mass movement on a slope.** Afforestation is when trees are planted on slopes. It is often done in an attempt to stabilise unstable or potentially unstable slopes. • Trees will intercept and absorb water, which reduces water in soils, decreasing the likelihood of high pore water pressure and therefore a reduction in shear strength. • Reducing the amount of water on slopes and in soils • Roots will bind soil material, increasing shear strength and helping to prevent the effects of gravity leading to mass movement such as landslides or slumping. This may reduce shallow landsides but have little effect on large, deep-seated landslides. • Afforestation may help to reduce the overall water load and content of the rocks and sediments in an area, which might reduce the weight of the material and decrease the effects of gravity that lead to mass movements. However, this may be counterbalanced by the weight of the trees. • If the slope has exposed rock surfaces, then trees can slow down forms of physical weathering which can lead to mass movement. **1 mark** for each explanatory point.	3

Question	Answer	Marks
6(b)	**Explain how the type and rate of weathering is influenced by precipitation.** Reference to the Peltier diagram is useful here. Availability of water is one of the main components of Peltier's diagram that describes the impact of climate on weathering. There should be a general awareness that weathering is more effective with the presence of water, with precipitation of less than 20cm/year mainly resulting in only slight weathering. Certain types of weathering require water to be active, for example most forms of chemical weathering operate through the medium of water e.g. hydrolysis, carbonation, chelation. Therefore, a lack of precipitation will reduce this type of weathering. It is also likely that if there is a reduced amount of water available through precipitation these forms of weathering will be limited. Physical weathering also requires water to operate e.g. freeze–thaw, salt crystallisation, but a change in temperature is also an important factor. Greater availability of water through precipitation will affect the rate of weathering – the more water there is, the greater the opportunity for chemical reactions etc. The emphasis should be on explanation and there should be a balance between chemical and physical weathering. Award marks based on the quality of explanation and breadth of the response using the marking levels below. **Level 3 (6–8)** Response clearly explains how the type and rate of weathering is influenced by precipitation. Response is well founded in detailed knowledge and strong conceptual understanding of the topic. Examples used are appropriate and integrated effectively into the response. **Level 2 (3–5)** Response explains how the type and rate of weathering is influenced by precipitation. Response develops on a largely secure base of knowledge and understanding. Examples may lack detail or development. **Level 1 (1–2)** Response describes and/or explains how the type and/or rate of weathering is influenced by precipitation. Knowledge is basic and understanding may be inaccurate. Examples are in name only or lacking entirely. **Level 0 (0)** No creditable response.	**8**

Question	Answer	Marks
6(c)	**With the aid of examples, assess the extent to which subduction is involved in the formation of tectonic landforms.** Candidates are free to develop their own approach to the question and responses will vary depending on the approach chosen. Whichever approach is chosen, essays which address the question and support their argument with relevant examples will be credited. There may be detailed consideration of a case study/one or more examples, or a broadly conceived response, drawing on several examples to illustrate the factors involved. The main tectonic landforms are volcanoes, fold mountains, ocean trenches, volcanic island arcs, mid-ocean ridges and fault valleys. Subduction is when one oceanic plate is forced below either another oceanic plate or continental plate. Landforms associated with subduction are volcanoes, fold mountains, ocean trenches and volcanic island arcs depending on which plates are involved. Some volcanoes are associated with sea floor spreading or mantle plumes at hot spots e.g. Hawaii. Some fold mountains are associated with collision between two continental plates with no major subduction and melting of the crusts, therefore no volcanic action. Mid-ocean ridges are the result of magma rising at sea floor spreading sites. Fault valleys are the result of plates moving apart e.g. East African Rift Valley. These considerations will form the basis of the assessment. Award marks based on the quality of the response using the marking levels below. **Level 4 (12–15)** Response thoroughly discusses the extent to which subduction determines the formation of tectonic landforms. Examples used are appropriate and integrated effectively into the response. Response is well founded in detailed knowledge and strong conceptual understanding of the topic. **Level 3 (8–11)** Response discusses the extent to which subduction determines the formation of tectonic landforms but may be unbalanced. Examples may lack detail or development. Response develops on a largely secure base of knowledge and understanding. **Level 2 (4–7)** Response shows general knowledge and understanding of the extent to which subduction determines the formation of tectonic landforms. Response is mainly descriptive or explanatory with limited use of examples and understanding of the topic may be partial or inaccurate. Some concluding remarks. General responses without the use of example(s) will not get above the middle of Level 2 (6 marks).	**15**

Question	Answer	Marks
6(c)	**Level 1 (1–3)** Response may broadly discuss the extent to which subduction determines the formation of tectonic landforms but does not address the question and does not come to a convincing conclusion. Response is descriptive, knowledge is basic and understanding is poor. **Level 0 (0)** No creditable response.	