Cambridge Assessment International Education

Cambridge International AS & A Level

GEOGRAPHY **9696/11**

Paper 1 Core Physical Geography **October/November 2022**

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 October/November 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level 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)

Annotation	Meaning	Use
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)	**Table 1.1 shows the size of sediment in a river channel at three locations.** **State the difference in percentage of the 10.01–100.00 mm sediment size between location X and location Y.** 16% (Accept 16 as percentage is specified in the question)	**1**
1(b)	**Compare the sediment sizes at the three locations shown in Table 1.1.** The main points that could be mentioned are: • Sediment size seems to be increasing from Z to X • Y is intermediate between X and Z except for sizes 0.11–1.00 mm and 10.01–100.00 mm • No sediment of size 10.01 mm and over at location Z • No sediment of size 0–0.01 mm at X • Much larger percentage of sediment size 1.01–10.0 mm at location Y • Similar percentage of sediment size 0.11–1.0 mm at locations X and Z There are other points that could be mentioned. Four relevant points for 4 marks.	**4**
1(c)	**Explain why the sediment size in a river channel might vary at different locations.** There are two main factors governing the variation in size of river sediments at various locations. These are sediment supply and transport/erosion. Supply of sediments is largely a function of: • Variations in sediment size in bed and banks for erosion and transport • Variations in sediment size brought in by tributaries and mass movement • Obstacles to sediment movement such as coarse material being trapped by obstacles or dams The effect of transport and erosion is governed by: • Velocity for transport and deposition with finer particles being transported further downstream • Erosion/attrition at various locations reducing the size of particles 1 mark for each simple explanation, 2 marks for a developed explanation up to a maximum of 5 marks.	**5**

Atmosphere and weather

Question	Answer	Marks
2(a)	**Fig. 2.1 shows methane emissions, by sector, in the USA in 2018.** **Fig. 2.2 shows nitrous oxide emissions, by sector, in the USA in 2018.** **State the difference in percentage of methane emissions between energy and waste shown in Fig. 2.1.** Candidates are required to interpret the pie section for both energy and waste, and then calculate the difference. Energy = 39%, Waste = 20% and therefore accurate difference = 19 (%). 2 marks for accurate difference of 19 (% and working not required). 1 mark for less accurate difference of 17, 18, or 20 (% and working not required).	**2**
2(b)	**Compare the emission sources for methane and nitrous oxide as shown in Fig. 2.1 and Fig. 2.2.** The main points of comparison are: For methane (Fig. 2.1): energy (39%) and agriculture (39%) are the greatest, followed by waste (20%) with forestry and industry almost negligible (2% and 0%). For nitrous oxide (Fig. 2.2): overwhelmingly agriculture (80%), followed by energy (10%) with a small proportion from industry (6%) with forestry and waste negligible (2% and 2%). Four relevant points for 4 marks. Data/figures required for full marks.	**4**
2(c)	**Explain the role of greenhouse gases in global warming.** The explanation needs to focus on: • The types of greenhouse gases (carbon dioxide, methane, water vapour, ozone, nitrous oxides, CFCs) • How they allow incoming short-wave radiation to pass through the atmosphere • How they trap outgoing longwave radiation • Leading to an increase in temperature and global warming 1 mark for each simple explanation, 2 marks for a developed explanation up to the maximum.	**4**

Rocks and weathering

Question	Answer	Marks
3(a)	**Fig. 3.1 shows the range of speeds of selected mass movements.** **State the range of speeds for earthflow/mudflow.** From 1.5 m/year to 3 m/sec. Units need to be specified. Accept slow/very slow to very rapid/extremely rapid as alternative.	**1**
3(b)	**Contrast the range of speeds of the mass movements shown in Fig. 3.1.** The main points of contrast that could be made are: • Rockfall has the highest speed of movement (extremely rapid), or 3 m/sec • Slump, although variable, has the lowest speed of movement (extremely slow) but can be rapid, or 1.5 m/day to 30 cm/5 years • Rock/debris slide has the highest range from very slow to extremely rapid, or 30 cm/5 years to 3 m/sec • Earth/mud flow has a large range from slow to very rapid, or 1.5 m/year to 3 m/sec Four relevant points of contrast for 4 marks. If specific mass movements not identified, then max. 2 marks.	**4**
3(c)	**Explain why mass movements have different rates of movement.** Explanations will vary depending on the type of mass movement chosen. The information in Fig. 3.1 could profitably be used to underpin the explanation. The range of speeds noted indicate that it is not simply the type of movement, apart from rockfall, that seems to be governing speed. Mention could also be made of heave, which is not shown in the figure. The main points that could be part of the explanation are: • Mass movements with a high water content, other things being equal, tend to be faster • This is the result of lubrication of failure planes in the case of rock/debris slides • Increase of pore water pressure in fine grained material, reducing internal cohesion for mud/debris flows • Mass movements move faster on steeper slopes, in general • Rapid increase of stress such as from external sources, for example earthquakes, can lead to sudden, fast movements • Particle by particle movement, such as heave, is always going to be slower • Rockfall will always be fast because of lack of support • Vegetation influences mass movements 1 mark for each simple explanation, 2 marks for a developed explanation up to the maximum.	**5**

Section B

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

Hydrology and fluvial geomorphology

Question	Answer	Marks
4(a)(i)	**Describe the process of throughflow on slopes.** Throughflow is: • the downslope movement of water/to river channel • in the soil • after infiltration Three relevant points for 3 marks.	**3**
4(a)(ii)	**Explain how the type of vegetation affects the shape of a storm hydrograph.** The elements of the storm hydrograph that need to be considered are: steepness of the rising limb, peak discharge, lag time, steepness of the falling limb, and duration (width) of the storm hydrograph. All these can be affected depending on the type of vegetation discussed. The key element of the explanation will be in terms of the amount of interception of water by the various types of vegetation. Trees will intercept more water than grassland or low shrubs. In general terms, deciduous trees will intercept more water than conifer trees except when the deciduous trees lose their leaves. The effect on the hydrograph should be assessed following these discussions. Four relevant points for 4 marks.	**4**

Question	Answer	Marks
4(b)	**Explain the formation of river cliffs and point bars in a meandering river channel.** Explanation will be in terms of helicoidal flows instigated by the contrast between pools and riffles with the undercutting on the outside bend and deposition on the inner bend. Much of the information can be portrayed in a clear, annotated diagram and should be given credit. Award marks based on the quality of explanation and breadth of the response using the marking levels below. **Level 3 (6–8)** Response describes the two features of a meandering channel, with an explanation based on pools and riffles and helicoidal flow. 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 the two features of a meandering channel, with an explanation which is limited in some respect. Helicoidal flow may be incompletely understood. Response develops on a largely secure base of knowledge and understanding. Examples may lack detail or development. **Level 1 (1–2)** Response describes the two features of a meandering channel but with little explanation. 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)	**With the aid of examples, assess the extent to which it is possible to reduce the impacts of river floods.** 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. Impacts include death of people and animals, damage to buildings, infrastructure and farmland, disruption to people's lives. The emphasis should be on hard and soft engineering and prediction of imminent flooding. There need not be a complete balance between hard and soft engineering, but both should be discussed with an assessment as to how they might reduce the impacts of floods. Cost is a crucial factor. Discussions may also include building design and environmental factors. 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 it is possible to reduce the impacts of river floods. It is well balanced with respect to both hard and soft engineering and other strategies. 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 it is possible to reduce the impacts of river floods but the discussion of hard and soft engineering 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 it is possible to reduce the impacts of river floods. 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 the extent to which it is possible to reduce the impacts of river floods 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.	**15**

Atmosphere and weather

Question	Answer	Marks
5(a)(i)	**Define the atmospheric terms *sublimation* and *radiation cooling*.** Sublimation is the change of state from a solid state, usually ice, to a gaseous state or vice versa (1) without going through the intermediate state (1). Radiation cooling is the loss of temperature at or near the ground surface (1) by outgoing longwave radiation, usually at night (1).	**4**
5(a)(ii)	**Describe the difference between sensible heat transfer and latent heat transfer**. Sensible heat is the transfer of heat into or out of an area by either convection, conduction, or advection. Latent heat is heat either absorbed by evaporation or released by condensation. Mark as 2/1 or 1/2 depending on detail.	**3**

Question	Answer	Marks
5(b)	**Describe and explain the global latitudinal pattern of radiation excesses and deficits.** Both description and explanation could be provided by diagrams but diagrams are not required. There is generally radiation excess in the tropics and deficits in high latitudes depending on a number of factors. The pattern is governed by the apparent shift north and south within the tropics of the overhead sun which provides the radiation input. This is affected by the angle of incidence of the sun's rays. Effective radiation at the ground surface will also depend on the albedo of the various surfaces. In equatorial zones, cloudiness is a factor and in the high-pressure belts lack of cloud cover is relevant as is discussion of albedo of snow and ice in high latitudes. Ocean currents and wind systems may also be considered. If a diagram is used, then credit can be given for knowledge and understanding. Award marks based on the quality of explanation and breadth of the response using the marking levels below. **Level 3 (6–8)** Response describes and explains the latitudinal pattern of radiation excesses and deficits. 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 latitudinal pattern of radiation excesses and deficits but in a partial way. Response develops on a largely secure base of knowledge and understanding. Examples may lack detail or development. **Level 1 (1–2)** Response describes the latitudinal pattern of radiation excesses and deficits but the explanation is limited. 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)	**'Convection is the main cause of precipitation.'** **With the aid of examples, how far do you agree with this statement?** 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 causes of precipitation are frontal uplift, convection and orographic uplift. All three processes need to be discussed for an efficient assessment. Convection clearly needs heat and a moisture source, orographic uplift needs a topographic barrier and frontal precipitation obviously needs frontal genesis which tends to be more prevalent in mid to high latitudes. Award marks based on the quality of the response using the marking levels below. **Level 4 (12–15)** Response thoroughly discusses the causes of precipitation and provides an assessment of the importance of convection with respect to the other main causes. 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 causes of precipitation and provides some assessment of the importance of convection but may be unbalanced with respect to the other two causes of precipitation. 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 causes of precipitation and provides a limited assessment of the importance of convection. 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 the causes of precipitation and provides a partial assessment of the importance of convection 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.	**15**

Rocks and weathering

Question	Answer	Marks
6(a)(i)	**Define the weathering terms *hydrolysis* and *pressure release (dilatation).*** Hydrolysis is a chemical process (1) where water reacts with minerals in a rock (1) leading to its decomposition (1). 2 marks. Pressure release (dilatation) is a physical weathering process (1) where rock becomes fractured (1) when weight (pressure) is removed from off it (1). 2 marks.	**4**
6(a)(ii)	**Briefly explain how a rock can be weathered by heating and cooling**. Heating and cooling of a rock leads to expansion and contraction of the rock (1) and its constituent minerals, governed by the albedo of the rock and minerals (1). This stresses the rock which, over time, may lead to disintegration (block or granular weathering) of the rock (1). Freeze-thaw is also acceptable and requires explanation for full marks. Three points for 3 marks.	**3**

Question	Answer	Marks
6(b)	**Explain how the movement of tectonic plates leads to the formation of ocean trenches and ocean ridges.** Ocean trenches are formed at converging plate boundaries by the subduction of one plate below the other, causing a deep-sea trench. Ocean ridges are formed at divergent plate boundaries, leading to the escape of magma which will produce ocean ridges. Award marks based on the quality of explanation and breadth of the response using the marking levels below. Detailed diagrams alone could reach Level 3. **Level 3 (6–8)** Response explains how the movement of tectonic plates leads to the formation of ocean trenches and ocean ridges and is well balanced. 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 movement of tectonic plates leads to the formation of ocean trenches and ocean ridges but is unbalanced. Response develops on a largely secure base of knowledge and understanding. Examples may lack detail or development. **Level 1 (1–2)** Response explains how the movement of tectonic plates leads to the formation of ocean trenches and ocean ridges. 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)	**'Water is the most important factor affecting the type and rate of weathering.'** **With the aid of examples, how far do you agree with this statement?** 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. There needs to be a thorough discussion of the various weathering processes with an assessment as to the importance of water. Chemical weathering processes require water but heat is also important. Some physical weathering processes operate without water, such as granular disintegration, but some (freeze-thaw, salt crystallisation, hydration) also require water. There also needs to be a discussion of the role of rock type and structure in the weathering process. Vegetation can influence both chemical and physical weathering. Slope/aspect and human activity may be considered. Award marks based on the quality of the response using the marking levels below. **Level 4 (12–15)** Response thoroughly discusses the role of water in the type and rate of weathering with an assessment of other factors affecting the weathering. 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 role of water in the type and rate of weathering with an assessment of other factors affecting the weathering 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 role of water in weathering with limited assessment of other factors affecting the weathering. 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 the role of water in weathering 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.	**15**