GEO.PH13 Glacial Landscapes: Transportation and Depositional Landforms

Total Marks

AQA 8035 · Calculators not allowed · about 50 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Define the term 'supraglacial transport' in the context of glaciers and debris movement on and around ice in upland valleys.

(Total for Question 1 is 1 mark)

2 Define the term 'englacial transport' as used for debris movement within the body of a glacier in a mountain valley.

(Total for Question 2 is 1 mark)

3 State one example of subglacial transport, naming the mechanism that moves debris at the glacier base.

(Total for Question 3 is 1 mark)

4 Give TWO differences between unsorted till deposited directly by ice and sorted fluvioglacial outwash deposited by meltwater in front of a glacier.

(Total for Question 4 is 2 marks)

5 Name ONE type of moraine (lateral, medial or terminal) and give a brief description of where it forms relative to glacier ice in a valley setting.

(Total for Question 5 is 2 marks)

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6 Labelled diagram task context: a simple cross section sketch of two small valley glaciers joining is provided to students. On the sketch label where you would expect to find lateral moraine, medial moraine and terminal moraine, and give one brief reason for the position of each moraine in the valley context.

(Total for Question 6 is 4 marks)

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7 Describe the formation of a drumlin in a lowland moraine belt, including the role of moving ice and deposited material.

(Total for Question 7 is 4 marks)

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8 Compare and contrast erosional versus depositional glacial landforms, giving TWO differences and ONE similarity. Use the context of a former valley glacier to illustrate your points.

(Total for Question 8 is 4 marks)

9 Explain the formation of a terminal moraine ridge at the former snout of a glacier, using named processes of transport and deposition.

(Total for Question 9 is 6 marks)

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10 Give TWO ways meltwater from a glacier helps to sort and deposit fluvioglacial material in front of the ice.

(Total for Question 10 is 2 marks)

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11 A small glacier deposited 1,200 tonnes of unsorted till and 300 tonnes of sorted sand and gravel in its foreland during a single summer of melting. Calculate the percentage of the total deposited material that is fluvioglacial sand and gravel. Give your answer to one decimal place.

(Total for Question 11 is 2 marks)

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12 Name where a medial moraine forms and explain briefly why it appears in that position on a valley glacier.

(Total for Question 12 is 1 mark)

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13 Explain why a terminal moraine ridge is commonly used by geographers as evidence for the former maximum extent of a glacier. Include at least two linked points in your answer.

(Total for Question 13 is 3 marks)

14 Give TWO reasons why drumlins found in a cluster can be used to infer the direction of former ice flow.

(Total for Question 14 is 2 marks)

Mark scheme · GEO.PH13 Glacial Landscapes: Transportation and Depositional Landforms

Question 1

- **B1** material transported on the surface of a glacier, such as rocks and sediment, oe
- **Answer: Material transported on the surface of a glacier, such as rocks and sediment.**

Question 2

- **B1** material carried within the body of a glacier, trapped in the ice, oe
- **Answer: Material carried within the body of a glacier, trapped in the ice.**

Question 3

- **B1** e.g. basal sliding carrying debris along the glacier bed, oe
- **Answer: Basal sliding carrying debris along the glacier bed.**

Question 4

- **B1** unsorted till is a mixture of sizes from clay to boulders, oe
- **B1** sorted outwash is layered and sorted by size, with finer material carried further from the ice, oe
- **Answer: Unsorted till contains a mixture of sizes from clay to boulders; sorted fluvioglacial outwash is layered and sorted by size, with finer material carried further from the ice.**

Question 5

- **B1** one correctly named moraine type, e.g. lateral moraine, medial moraine or terminal moraine, oe
- **B1** correct description of where it forms relative to the glacier, oe
- **Answer: Example: lateral moraine, which forms as a ridge of debris along the side of a glacier where material falls from the valley wall onto the ice.**

Question 6

- **B1** lateral moraine labelled at the valley sides with reason, e.g. debris falls from valley walls onto the glacier edges, oe
- **B1** medial moraine labelled down the centre where two glaciers join with reason, e.g. two lateral moraines join as glaciers merge, oe
- **B1** terminal moraine labelled at the glacier snout with reason, e.g. deposited at the maximum extent of the glacier, forming a ridge across the valley, oe
- **B1** positions are correctly located relative to valley sides, centre and front, showing understanding of relative placement, oe
- **Answer: Lateral moraine: at the valley sides where debris falls onto glacier edges. Medial moraine: down the centre where two glaciers have joined and their lateral moraines have combined. Terminal moraine: a ridge across the valley at the glacier snout deposited at the glacier's maximum former extent.**

Question 7

- **B1** drumlins are streamlined, elongated hills of deposited glacial till, oe
- **B1** they are formed beneath moving glacier ice, with material moulded into a teardrop shape aligned with ice flow, oe
- **B1** stoss and lee profile: a steeper up-ice (stoss) end and a tapered down-ice (lee) end, oe
- **B1** formation involves deposition of subglacial till and reshaping by ice movement and meltwater, oe
- **Answer: Drumlins are streamlined, elongated hills of deposited glacial till formed beneath moving glacier ice. Subglacial till is deposited or moulded into a teardrop shape aligned with the ice flow, giving a steeper stoss end facing the incoming ice and a tapered lee end downstream; meltwater and ice movement help reshape and compact the material.**

Question 8

- **B1** difference 1, e.g. erosional landforms are created by ice removing material (e.g. corrie, arête), depositional are created by ice depositing material (e.g. moraine, drumlin), oe
- **B1** difference 2, e.g. erosional landforms are often bedrock features with steep profiles, whereas depositional features are made of unsorted till or sorted outwash, oe
- **B1** similarity, e.g. both are formed by the action of glaciers and so can indicate former ice movement and environment, oe
- **B1** contrast illustrated with valley glacier context, e.g. a valley floor scoured into a U-shape versus moraines left at the margin, oe
- **Answer: Differences: erosional landforms are formed by ice removing rock and often produce bedrock features with steep profiles, while depositional landforms are built from material left by ice or meltwater, such as unsorted till or sorted outwash. Similarity: both types are produced by glacier action and can indicate former ice movement. Illustrated: a valley glacier can carve a U-shaped trough by erosion while leaving terminal and lateral moraines where material is deposited.**

Question 9

- **Level 3** (5-6): A detailed explanation that links ice transport processes (supraglacial, englacial, subglacial) and meltwater sorting to the build up of a terminal moraine, with clear sequencing of events and reference to the glacier margin and stability.
- **Level 2** (3-4): A clear explanation that describes deposition at the glacier snout and mentions at least one transport process and the idea of an ice margin, but with less sequencing or fewer links between processes and landform shape.
- **Level 1** (1-2): Simple statements about material being deposited at the glacier front with little development or linking of processes.
- **Indicative content:**
  - Material carried supraglacially, englacially and subglacially is transported toward the glacier snout as the ice flows.
  - When the glacier margin becomes stationary during a period of balance between accumulation and ablation, debris carried by the ice is deposited at that position, forming a ridge across the valley.
  - Meltwater at the snout can rework finer material, but the main ridge consists of unsorted till dropped by melting ice and ice-contact deposition.
  - Terminal moraines mark the former maximum extent of the glacier and can be built over several years by repeated deposition during retreats and readvances.
  - Reference to the ridge shape across the valley and to the presence of mixed sizes of material, distinguishing it from sorted outwash further downvalley.

Question 10

- **B1** flowing meltwater carries finer material further than coarse material, causing size sorting, oe
- **B1** water velocity changes lead to layering or bedding, with heavier particles dropping out first and finer particles deposited further away, oe
- **Answer: Flowing meltwater carries finer material further than coarse material, causing size sorting; changes in water velocity cause layering or bedding, with heavier particles deposited first and finer particles carried further.**

Question 11

- **M1** 300 / (1200 + 300) seen or 300 / 1500 seen, oe
- **A1** 20.0% cao
- **Answer: 20.0%.**

Question 12

- **B1** medial moraine forms down the centre of a glacier where two glaciers join, and is formed when the lateral moraines of the joined glaciers combine, oe
- **Answer: A medial moraine forms down the centre of a glacier where two valley glaciers have joined; it appears there because the lateral moraines from each glacier combine as the ice merges.**

Question 13

- **B1** terminal moraine marks the position where the glacier front was stable and deposited material, oe
- **B1** it forms a distinct ridge across the valley, making the former snout position easy to identify in the landscape, oe
- **B1** it contains unsorted till dropped directly by the ice, indicating ice-contact deposition at that maximum extent, oe
- **Answer: A terminal moraine marks where the glacier front was stable and deposited material, forming a distinct ridge across the valley; because it is built of unsorted till dropped directly by the ice, it clearly records the glacier's former maximum snout position and so is reliable evidence of extent.**

Question 14

- **B1** drumlins have a tapered lee end pointing in the direction of ice movement, oe
- **B1** streamlined alignment of multiple drumlins shows consistent ice flow direction, oe
- **Answer: Drumlins have a tapered lee end that points in the direction ice flowed, and a cluster of drumlins aligned in the same orientation shows a consistent former ice flow direction.**