GCE MARKING SCHEME

SUMMER 2018

GCE (LEGACY)
GEOLOGY - GL3
1213/01

INTRODUCTION

This marking scheme was used by WJEC for the 2018 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCE GEOLOGY - GL3 (LEGACY)

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Question 1

(a) (i) Roughly semi-circular/elongated N/S (1)
Band or zone (1)
Almost continuous (1)
Use of numbers - 1-2km wide *max 8km (1)
On either side of bay/in bay (1)
(2 max marks) [2]

(ii) Coastal location (1)
Undersea earthquakes – water movement (1)
Volcanic induced mass movement – water movement (1)
Eruption – tremors – water movement (1)
Shape of coastline (1)
Funnel (1)
(3 max marks) [3]

(b) (i) 90 (accept range 88 – 92) (1)
NW (1) [2]

(ii) Radial tilt from centre of caldera (1)
Greatest tilt along the northern rim (1)
Use of numbers in description (1)
(2 max marks) [2]

(c) Holistic
Active volcanoes
Tilt- ground inflation (must link to magma movement)
Associated with rising magma/filling of magma chamber
Causing seismic activity (movement of magma & fracturing)
Possible subsidence of caldera –seismic
Coastal shape indicated previous event
(3 max marks)
[3]

Total 12 marks

Question 2

(a) (i) V = 800 * (250-225)/1000 (1) (all 3 correct for 1 mark)
V = 800 * 0.025 or V = 20 m day^{-1} (1) [2]
(Check for follow on errors)

(ii) Grain size - Smaller grain size decreases flow velocity (Greater surface tension)
or
Grain Shape – Angular/less rounded shape decreases flow velocity (Angular grains fit better into pores)
or
Grain Sorting - Poorer sorting decreases flow velocity (Smaller grains infill pores)
or
Greater degree of cementation decreases flow velocity Less pore space available)
or
Reference to packing (cubic v rhombic etc) (Porosity reduction)
Any one for texture (1); explained (1)
Answer must be comparative (or max 1) [2]

(b) (i) Describe (max 2 marks)
Steep drop then Rapid rise (1)
Use of numbers (1)
Drop = 4 - 9m in 1 day then levelling off ~10 m
Rise = 5 m in 1 day the levelling off back to 4.5 m
Similar rate of change (drop and rise) (1)
Explain – Holistic (max 2 marks)
Pumping removes water to lower table AND vice versa (1 max)
Further qualification (1):
Rapid drop – pumping greater than recharge (rapid initially as pore water rapidly removed to form cone of depletion – slows to steady state as recharge is more in equilibrium with pumping)
Rapid rise when pumping stops (as groundwater outside flows into cone of depletion quickly along steep gradient. Slows with time as pressure difference reduces)
(max 2 + 2 marks) [4]

(ii) Holistic
Water loss is greater than recharge (input< output)
Reference to low precipitation compared with output
Not enough time for recharge water to have any effect
Other boreholes still pumping/greater natural loss from springs etc.
(max 2 marks) [2]

(c) Holistic
Reduction in pore water pressure
pressure/weight of strata above
causes - grains to distort and repack
Clay shrinkage
Examples credited (e.g. Pisa)
(max 3 marks) [3]

Total 13 marks

Question 3

(a) Explain how **two** of the following factors might increase the risk of geohazards associated with mass movements of rock and soil.

- slope angle and direction
- lithology
- weathering
- groundwater/rainfall changes [10]

Slope angle and direction:
slopes above 35 degrees are often unstable (exception – solifluction etc). Friction is greater than forces of gravity. Result = rockfall/slides, rotational slip, slumping, debris flows (credit DIP ANGLE related to slope).
Lithology:
Shale, clay etc. are incompetent and will flow/slip under load pressure and lubrication – rotational slip.
Sandstone/Limestone – joint patterns/bedding.
Crystalline igneous and metamorphic =strong but less stable if cleavage present.
Weathering:
Competent rock (granite) is reduced to clay – loses cohesion between grains/joints density
Physical/Chemical/Biological effects on rocks.
Groundwater/rainfall changes:
Acts as a lubricant to accelerate movement by reducing friction between blocks/particles.
Pore pressure, erosion.

(5 marks each to include credit for examples and diagrams)

(b) Explain how mass movement of slopes might be stabilised [15]

Reprofile to below the stable angle (approx. 35 degrees depending on other factors)
Drainage control – drains, pipes etc to remove surface water.
Planting trees – reduces interception, removes water and roots bind the soil.
Engineering structures:- Gabions, retaining walls, shotcrete, rock bolts etc.
Prevention of instability caused by human activity.
Other sensible specifically related to case studies.
Credit for examples
(Max 15 marks)

Total 25 marks

Question 4

(a) Describe the geological problems often associated with the extraction of rock or minerals. [10]

stability of working faces
ground subsidence
gas explosions
flooding
surface/groundwater pollution
waste tipping

(b) Explain how the extraction of rock and minerals may result in the pollution of surface and groundwater. [15]

Acid mine drainage pollution explained
Pyrite/iron oxidised in acidic mine water
Waste tipping - pollution effect of percolating water
Pumping - contamination with saltwater explained
Mine tailings/settlement lagoon breaches.
Examples credited

Total 25 marks

Question 5

(a) Describe a range of engineering activities that can increase or decrease the rate of longshore drift in coastal areas. [10]

Longshore drift described
Groynes, breakwaters, harbours, seawalls, rip-rap, slope drainage and reprofiling etc. Examples credited.
Cliff erosion is slowed by groynes/seawalls/rip rap etc but possibly increased in other areas that are unprotected.
Soft engineering – beach replenishment, revegetation, managed retreat.

(b) Explain the risk of hazard for **two** of the following:

(i) building a dam on faulted limestone bedrock
(ii) the development of a housing estate on a former landfill site.
(iii) bridge foundations built on former lake sediments. [15}

(i) Limestone strong but prone to weathering - carbonate
Underground caverns – sinkholes
Reference to jointing and action of water - erosion
Faulting – reactivation- weaknesses for water leaking beneath
(max 7 plus 1)

(ii) Reference to methane gas escape – explosion
Subsidence – reduction in volume of waster with degradation
Groundwater pollution potential
Examples given – e.g. Loscoe
(max 7 plus 1)

(iii) Lake sediments described. Significance of water.
Effect of vibration – earthquakes
Amplification of vibration – liquefaction of sediment
Example – Cypress freeway.
(max 7 plus 1)

Total 25 marks