GCE MARKING SCHEME

SUMMER 2017

GEOLOGY GL3
1213/01

INTRODUCTION

This marking scheme was used by WJEC for the 2017 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

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SECTION A

1. (a) (i) Any two of:
Increased over time
Fluctuates
Relevant use of data [2]

(ii) Any two of:
Positive correlation (both increasing)
Anomalies discussed
Earthquakes more variable
Relevant use of data [2]

(b) (i) Rising line to edge of stage 1 (1)
Then a horizontal line/rising line to end of stage 2 (remaining above the end of stage 1) AND drop at eruption on the border between stage 2 and 3. (1) [2]

(ii) A max of 4 of the following points:

Good for prediction:
Data can be applied to the model (1)
Cycles and patterns can be observed and used to predict forthcoming events (1)
Indicates magma moving (1)

Poor for prediction:
Do not know how long stages I and II will last (1)
Do not know where this represents on the cycle (1)
How much magma has moved is unknown (1)
Background level is unknown (1)

Credit any other sensible answers
Must refer to the figures and evaluate for full marks [4]

(iii) A max of 3 of the following:
Gases named e.g. sulphur dioxide, carbon dioxide (1)
Levels recorded may show similar pattern to the data in Figures 1 a and b/ correlations observed (1)
Increase in gases could provide further evidence of imminent eruption (1)
Increase in gases indicates magma movement (1)
Increase in gases indicates increased stress/pressure/fracturing in surrounding rock (1)
Decrease in gas due to blocked vents (1)
Magma rises and pressure drops, so gas comes out of solution. (1) [3]

Total 13 marks

2. (a) Description

Relevant use of both values or difference between values (1)

Explain

Max one mark from the following:

Cement dissolved/roots/opening of joints and cracks/freeze thaw/hydrolysis/salt crystal growth (1) [2]

(b) A max of 3 of the following

Longshore drift (1)

Beach starved of sand (1)

Longshore drift to the North (1)

Prevailing wind (1)

Increased erosion (1)

Waves hit base of cliff (1)

Increased energy of the environment (1) [3]

(c) (i)

Factor	A	B
Dip	Not a risk	Risk
well jointed sandstone	Risk	Risk
Fault	Risk	Not a risk
Shale	Not a risk	Not present
Steep cliffs	Risk	Risk
Sheltered by headland	Not a risk	Risk
Proximity to the sea	Risk	Risk

There must be a comparison of risks for 4 marks

A minimum of 2 factors discussed for 4 marks

Up to 2 marks per factor [4]

(ii) Answers must relate to the cliff face

Shotcrete, rock bolts, slope re-profiling, netting, drainage, toe support for the face. (1)

Two max for explanation (must relate to site A or B for full marks) [3]

Total 12 marks

SECTION B

Answer **one** *question from this Section on the following pages.*

The marks you will be awarded in your essay take into account:
evidence of geological knowledge and understanding;
the use of geological examples;
legibility, accuracy of spelling, punctuation and grammar;
the selection of an appropriate form and style of writing;
the organisation of material, and use of geological vocabulary.

EITHER,

3. (a) Describe the potential volcanic hazards that may result from ash fall and pyroclastic flows. [10]

Ash Fall:
Proximity to population- breathing difficulties/suffocation
Roofs etc collapsing from weight
Sheer volume of ash – towns buried
Crops/vegetation destroyed
Mixes with rain/rivers – becomes cement like – harmful to flora/fauna/ environment

Examples: Pinatubo/Pompeii/Montserrat etc credited

(max 5 marks)

Pyroclastic Flow:
Pyroclastic density current (gravity current)
Fast moving hot gas and rock fragments.
Speeds: up to 700km/h – cannot escape
Heat: up to 1000°C – will burn everything in path
Lethal
Travels down valleys/hugs slopes - villages destroyed
Can travel far and wide:
Can travel across water (hovercraft like) – Krakatoa (one flow reached the coast of Sumatra – 48km away)
Can spread laterally under gravity

Credit examples

(max 5 marks)

(b) Explain how the destructive effects of lava flows, lahars and gases can be effectively controlled to reduce risk. [15]

Lava Flows (max 5 marks)
Destructive effects: burn everything touched by lava flow, fires, poisonous gases kill people and local fauna, greenhouse gases released.

Controls:
Effects can sometimes be minimised but not eliminated through control.
Different lava flow types will require different strategies.
Attempts to control flow:

Heimaey (water control to halt/divert flow),
Etna (explosives, digging trenches to divert flow),
Nyiragongo (fast flowing 100km/h, heavy gas concentrations 70 killed – 1977, 2002 – monitoring, 400,000 people evacuated from Goma but still 147 people dies from asphyxiation from carbon dioxide – control not possible/attempted),
Gases released from flow cannot be controlled.

Lahars (max 5 marks)
Destructive effects: fast flowing (100km/h), deep, far flowing (300km) often travels down river valleys (mixes with ice or crater lake water or eruption-triggered thunderstorm rain from top of volcano) varies in consistency and temperature, turns to cement like mixture as cools, very dangerous, very destructive to all flora and fauna in its path.

Controls:
Large scale lahars cannot be controlled or diverted.
Ruiz: town of Armero destroyed, 25,000 deaths, 5 metres deep
Credit reference to small-scale dam/diversion strategies

Gases (max 5 marks)
Do not double credit a repetition of gases in lava flows but the Nyiragongo example is also applicable here.

Destructive effects: death by asphyxiation, global climate change

Controls:
Monitoring of gases
Evacuation of people

Workers mining/collecting sulphur in Indonesia can be given breathing apparatus but the gas emissions cannot be controlled.

Lake Nyos, 1986: carbon dioxide, colourless, odourless, silent, no smell, dense (hugs ground). People (1,700) and livestock killed. Lake now vented to prevent build-up of gas. Degassing tubes siphon water from the bottom layers of water allowing the carbon dioxide to leak safely. Control successful so far.

Global climate change due to volcanic greenhouse gases: evidence this has happened in the past. Controls not possible though anthropogenic addition to atmosphere should be avoided

Total 25 marks

OR,

4. (a) Describe and explain the causes of tsunamis. [10]

Do not credit strike/slip faults/transform faults/ San Andreas/conservative plate margins or MORs divergent plate margins

Convergent plate margins – in the oceans – example such as Pacific Plate/Eurasian plate near Japan.

Seismicity due to volcanic eruption e.g. Krakatoa

Large landslide into water e.g. Alaska/Tenerife/La Palma

Meteorite - Chicxulub

Candidates are likely to concentrate on convergent plate margins in oceanic locations. Credit diagrams and examples.

Stress builds up along plate boundary. Earthquake occurs as stress is released along with vast amount of energy. VERTICAL displacement of plate. Water column is in turn displaced.

A wave can be created that is @1m high and @100km in length. This travels in all directions from the point of origin at high speed @800km/h across vast expanses of water. Some energy is lost as tsunami wave travels.

The damaging part of the tsunami is caused when wave approaches land. The wave slows down at front due to friction with sea bed. Wave height increases and length decreases.

Max 7 if only one cause

(b) Discuss the factors that affect the level of devastation in coastal areas following a tsunami. [15]

Depth of sea – deeper sea faster tsunami
Length/shape/shallowness of continental slope – affect speed/height of wave
Valleys – channel wave, higher/faster
Flat land – lateral/widespread devastation, wave slowed by friction, no high land to escape to
Land use of coastal area – built up/farming/rural
Warning given/not given – Indian Ocean 2004
Education/procedures – people knowing what to do – Japan 2011
Tsunami defences/sea walls
Proximity to epicentre – Banda Aceh 2004 – earthquake magnitude 9 followed by tsunami @15 minutes later
Population density, building type and density
Human activity in the area of the hazard e.g. Fukishima
Disease
Affluence of country / level of development / emergency responses

Total 25 marks

OR,

5. (a) Describe the problems associated with the overuse of aquifers. [10]

Salt water incursion
Interference with surface water
Cone of depression
Surface subsidence
Reduction in pore water pressure results in grains repacking
Reducing capacity of aquifer

Expect diagrams and credit examples.

Max 7 if only one problem

(b) With reference to **three** of the following explain the geological factors that have to be taken into consideration in the construction of a multi storey building. [15]

- Rock Type

Limestone – can have cavities,
Igneous rocks – expensive to put in piles but solid foundations
Sedimentary rocks need to be tested for strength to withhold weight of building.
Mudstones/clays - slumping

- Rock Structure

Faults and folds
Effects on porosity and permeability
Thickness and dip of beds.

- Depth to water table

Changes in water table levels can change competency of underlying rocks/subsidence
Shallow water table may lead to flooding at periods of high rainfall
Limestone may be dissolved

- Depth to rock head

Large overlying drift deposits can be a problem
Piles may have to be deeper
Increases cost
If very deep could cause building to be unstable

- Radon Gas

Source rocks e.g. granite/black shales
Pathways e.g: Limestone joints and fractures
Impact of impermeable drift
Carcinogenic
Venting buildings on ground floor/or lower storeys may be necessary.
Only really a problem if people sleep in areas of trapped gas.

Max 5 marks for each of the three chosen factors
Must relate factors to the construction of a building for the 5 marks each time

Total 25 marks