GCE MARKING SCHEME

SUMMER 2016

GEOLOGY GL3
1213/01

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INTRODUCTION

This marking scheme was used by WJEC for the 2016 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.

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SECTION A

1. (a) (i) Dyke (1)

Discordant (1) [2]

(ii) Dyke impermeable (1)
Crystalline rock (1)
Effect of pumping /water extraction (1)
Slows/prevents lateral flow (1)
(2 max) [2]

(iii) Correct line on **Figure 1a**

Cone of depletion on through **C** (1)

Line above wells **A** and **B** and reaches edge of island/salt water interface (1) [2]

(b) (i) Description referring to any of following
Size of grains (1)
Sorting (1)
Vesicles (1)
Reference to vesicle size (1)
(2 max) [2]

(ii) Permeable/capacity to allow water to pass through/interconnected spaces (1)
Porous/space to store water (1)
(Porosity with no reference to permeability is not credited)
Fractures/bedding (1)

(2 max) [2]

(c) Holistic
Compaction of pore spaces
So reduction in capacity of aquifer
Salt water incursion
Cone of depletion/exhaustion increases
Well heights lower [3]

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2. (a) (i) Arrow marked E in correct place [1]

(ii) Line drawn correctly (1)

Loop or circle around 5/6 in SE of map (1) [2]

(b)

Modified Mercalli intensity descriptions	Modified Mercalli intensity value
vibrations - similar to a passing lorry	III
waves form on ground surface	XII
ground cracks, pipes break	IX
trees sway, falling objects	VI

all three correct for (2)
any one correct for (1) [2]

(c) (i) The intensity of the earthquake declines with distance from the epicentre/ negative correlation (1)

Most damage due greater energy nearer epicentre (1) [2]

(ii) Line drawn starting at 9 declining with distance from epicentre (1)

Shows rise – 9, 8, 7, 5, 6, 5 pattern/correct shape (1) [2]

(iii) Holistic
Wave amplitude greater in unconsolidated sediments
Liquefaction may cause greater damage to building foundations
Building quality – life safe/earthquake proof
Example/quote from **Figure 2a** e.g. Santa Monica
Remote areas have less people to feel effects (and vice versa)
Land use zoning
Other reasonable comment [3]

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SECTION B

3. (a) *Describe the geological factors that need to be considered in order to avoid ground instability in major civil engineering works.* [10]

Dip of strata
Folding
Faulting
Rock cleavage
Joint patterns
Rock strength and stability

Examples credited for above
Case studies credited

(b) *Explain how civil engineering can be used to avoid interference with the coastal system (coastal erosion and deposition, longshore drift).* [15]

Case studies credited
Blackpool, Holderness Coast
Expect diagrams
Longshore drift – groynes
Coastal erosion: rip rap, off shore islands, (Sitges, Spain) cliff stabilisation
Coastal deposition: man made spits, bars (such as harbour entrances)
Tsunami coastal protection can be credited

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4. (a) *Describe how surface groundwater pollution can result from **each** of the following human activities.*

(i) *Waste disposal*

(ii) *Mining* [10]

(i) Landfill hazard of escaping leachate
Other contaminants – oil, highly toxic and radioactive waste, acidity, named contaminants (cadmium, lead etc.)
Reference to porosity and permeability of aquifer
Methane dissolves in water

(ii) Mine drainage pollution described – pyrite/iron oxidised in acidic mine water
(pyrite + oxygen + water → ferrous iron + sulfate + acidity)
Leaching mine waste tips – surface pollution into groundwater
Examples credited

(max 7 for each)

(b) *For **one** of the human activities in (a), explain how the problems associated with groundwater pollution might be overcome or reduced.* [15]

Landfill liners identified (graded liners, impermeable bentonite clay, geomembranes) and explained in association with current legislation

Waste management strategies in landfill design and management (covering with clay, choice of site, pumping leachate and gas etc.)

Examples credited
Annotated diagrams credited

OR

Acidity is buffered by the addition of alkaline chemicals such as calcium carbonate, sodium hydroxide, sodium bicarbonate or anhydrous ammonia

These chemicals raise the pH to acceptable levels and decrease the solubility of dissolved metals; precipitates form that settle from the solution

Limestone - anoxic limestone drain - buried bed of limestone constructed to intercept subsurface mine water flows and prevent contact with atmospheric oxygen

Diversion well - acidic water is conveyed by a pipe to a downstream "well" which contains crushed limestone aggregate

Anaerobic /aerobic wetlands – passive treatment using plants and compost

Examples credited
Diagrams credited

(max 15)

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5. (a) *Describe the extent to which **two** of the following can be used to predict earthquakes.*

(i) *Groundwater levels and pressure*

(ii) *Ground movement*

(iii) *Radon gas emissions* [10]

	First	Secondly
Groundwater levels and pressure	Water drains into microcracks – water table lowered, pressure reduces	Water migrates in from groundwater – water table rises, pressure increases
Ground movement	Microcracks opening and closing, raising of ground surface as tension builds prior to an earthquake	
Radon gas emissions	Gas escapes as microcracks open so emissions increase	Cracks fully open – rate stays same

Ground movement can also include larger scale movement: corals/terrestrial fossil record cycle, uplift of land due to tension prior to an earthquake, seismic gap theory, GPS monitoring

Examples and case studies credited – e.g: Anatolian fault.

By monitoring the above and looking for the first change to background levels followed by the second indicates a build-up of stress
After the earthquake levels would return to normal background levels

Prediction by these methods is currently unreliable, forecasting rather precise prediction.

(max 7 for each - for full marks some assessment of the extent to which methods can be used must be included)

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(b) *Using one or more case studies explain the relationship between earthquakes and active fault zones.* [15]

Examples/Case studies credited

Diagrams – credited

Subduction zones – earthquakes as plate descends, from shallow focus at the plate boundary at the surface to deeper focus under over riding plate (Pacific Rim)
MOR – shallow focus near plate boundary (mid-Atlantic Ridge)
Transform faults – shallow focus along fault (San Andreas)
Continental/continental – along/under mountain chains (Himalaya)
Volcanoes - associated faults with magma movement (Hawaii)
Anatolian fault explained
Magnitude of earthquakes in association with plate boundaries (many smaller scale events along MOR's – convergent/transform faults larger scale)
Reference to earthquakes away from active fault zones

Full marks can be gained for compression, tension, shear movements due to pressure build-up and release producing P and S waves so long as case studies are used to back up points

(max 12 if no case studies/example)

Full marks can be gained entirely through earthquake case studies if candidates use two or more examples from differing types of plate boundaries

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MARK BAND CRITERIA FOR AS ESSAYS

Summary Description	Mark out of 25	Mark out of 15	Mark out of 10	Criteria
Excellent	21 - 25	13-15	9-10	Not the perfect answer but purposeful, demonstrating a secure grasp of knowledge and understanding and few significant omissions. Well-supported and illustrated with detailed examples selected from named geological situations. Ideas expressed fluently in logical form using appropriate geological terminology. Few errors in grammar, punctuation and spelling.
Good/Very good	16 - 20	10-12	7-8	Sound answers with relevant material providing evidence of good knowledge and understanding. May be limited in terms of supporting material and breadth of coverage but appropriate examples selected. Ideas expressed with clarity with only occasional errors in grammar, spelling and punctuation.
Modest/ Quite Good	11 - 15	7-9	5-6	A reasonably secure grasp of basics but some deficiencies in knowledge and understanding although use is made of geological terminology. Examples and illustrations may lack detail or may not relate to real geological situations. Reasonable use of language with adequate spelling and punctuation.
Weak/ Minimal	6 - 10	4-6	3-4	Answers show limited basic knowledge and understanding, lacking directness and organisation; tendency to rehash prepared material and answer by inference. Superficial use of examples. Deficiencies in use of language evident; weaknesses in spelling and punctuation apparent.
Very weak	1 - 5	1-3	1-2	Little evidence of knowledge and understanding with erroneous or repeated material evident. Candidate is unable to address the question. Largely irrelevant; possibly too brief. Language skills poor, with spelling, grammar and punctuation errors becoming obtrusive.

Incorporated into this mark scheme is the assessment of candidates on their ability to organise & present information, ideas, descriptions & argument clearly & logically, taking into account their use of spelling, punctuation & grammar.

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