WJEC
CBAC

GCE MARKING SCHEME

GEOLOGY
AS/Advanced

JANUARY 2012

INTRODUCTION

The marking schemes which follow were those used by WJEC for the January 2012 examination in GCE GEOLOGY. They were finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conferences were held shortly after the papers were 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 conferences was to ensure that the marking schemes were 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' conferences, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about these marking schemes.

GL1

Q.1 (a) One stipe (1)
Thecae on one side of the stipe / uniserial (1)
Complex thecae or equivalent (1)
3.0 cm long **or** thecae 0.3 - 0.5 cm (1)
8 thecae (1)
Scandent / nema at the bottom / theca point upwards (1) [3]

(b) Older (1) **R**

Many more stipes (1)
Pendant (1)
Credit reference to opposite in graptolite A

It is the oldest free floating graptolite (1)
(No thecae) credit ref to complex thecae on graptolite A (1)
A is Silurian, this is Ordovician (1) - 3 max [3]

(c) (i) Free floating / capable of being dispersed or equivalent (1)
More widespread or equivalent (1)
Facies independent (1) - 2 max [2]

(ii) Rapid evolution / short lived (1)
Abundant (1)
Well Preserved (1)
Easily Identifiable (1) - 2 max [2]

(d) (i) 468 (1)
299 correctly subtracted (1) (should be 169 M yrs)
(No credit for 488-468) [2]

(ii) Erosion (1) **R**
Unconformity (1)
Of beds in between / above or equivalent (1)
Silurian / Devonian / Carboniferous missing (1) - 3 max [3]

15 marks

Q.2 (a) (i) 140 km (accept 136-144) (1) [1]

(ii) Correct working shown ie $\frac{[\text{answer (i)} - 100]}{100} \times 100$ (1)

44% (accept 38% - 50%) (1) [2]

(b) Convergent (credit destructive) (1)
Plates move towards each other / collision / compression (1) [2]

(c) (i) Thrust (1) **R**
Low angle (1) **R**
Hanging wall block up
Or footwall down (1)
Or rocks pushed over one another (1)
Or Fault Plane Dips to the downthrow side (1) - 3 max [3]

(ii) Plates equal density (1)
Both continental / same type (1)
Low density (1)
Plate too thick (1) - any 2 [2]

(d) (i) Left-hand box: arrow to S-W Right-hand box: arrow to N-E
Both correct for 1 mark [1]

(ii) Plate boundary **Y** (1) **R**

Y because

Fig 2a shows continent-continent lithosphere boundary (1)
Plates colliding here (1)
Reference to Himalayas / mountains / orogenic belt (1)

Not **X** because
Spreading ridge = divergent (1)
Oceanic not continental (1)

Not **Z** because
Trench indicates subduction (1)
Oceanic-continental boundary (1) - 4 max [4]

15 marks

Q.3 (a) Haematite (1) [1]

(b) (i) 5.3 m (accept 5.0-5.5) (1) [1]

(ii) Coarse to medium (1)
Become finer upwards (1) [2]

(iii) A (1) **R**
Finest grains (1)
Laminations (1) [3]

(c) Well rounded / rounded (1)
Well sorted (1)
0.4-0.8 mm (1) [3]

(d)

Rock Unit	Environment of deposition (1-5)	Explanation of evidence
C	2	Upward fining indicates river Poorly bedded = flash flood / rapid deposition Small scale cross bedding = flow in river
B	3	Dune cross bedding (large scale) Well sorted by wind Well rounded by attrition in wind
A	**5**	Fine grained = low energy lake Laminated = low energy lake Desiccation cracks = drying out

1 mark for each correct environment (number 1-4) (2) **R**

1 mark for each explained evidence but maximum of 2 in any box
-4 max (4) [6]

16 marks

Q.4	(a)	(i)	Coarse (1) **Size** – Phenocrysts 1-3 cm or Groundmass 2-5 mm (1) **Shape** – Euhedral (phenocrysts) or an/subhedral (groundmass) (1) Porphyritic (1) Phenocrysts (1) Groundmass (1)	- 2 max	
			Random orientation (1)	- 3 max	[3]
		(ii)	Granite (1)		[1]
	(b)	(i)	B banded / foliated or equivalent (1) B has finer crystals (1) B equigranular or equivalent (1) B has no euhedral crystals or equivalent (1)	- 2 max	[2]
		(ii)	Regional Metamorphism (1) High Temperature (1) High Pressure / directed stress (1) High Grade (1) Deeply buried (1)	- 3 max	[3]
	(c)	(i)	Pluton (1)		[1]
		(ii)	Rock **B** (1) **R** It lies below the unconformity (1) It is older than the conglomerate (1) Mineral Z is orthoclase / contains orthoclase (1) No orthoclase in marble (1) Arkose is too young (1) Pluton / rock **A** too young because cross cutting (1)	- 4 max	
			If answer rock **A** then credit: Mineral Z is orthoclase / contains orthoclase (1) No orthoclase in marble (1) Arkose is too young (1) **OR** If answer arkose then credit: Contains orthoclase / feldspar (1) No orthoclase in marble (1) Pluton / rock **A** is too young (1) **OR** If answer marble then credit: It lies below the unconformity (1) It is older than the conglomerate (1) Arkose is too young (1) Pluton / rock **A** is too young (1)	- 3 max	[4]

14 marks

GL3

Q.1 (a) Caldera (1)
Crater (1)
Pyroclastic flows / lahars = ash (1)
Steep, conical cone rather than fissure (1)
Credit - Sector collapse

(max 2 marks) [2]

(b) Radial pattern with some into the crater (1)
Following downhill, via valleys (1)
Steep slopes (1)
(max 2 marks) [2]

(c) (i) 15 ms^{-1} (1)
(Range 14 – 16) [1]

(ii) Wind speed stronger at 12 km (1)
Greater energy for transport (1)
(max 2 marks) [2]

(iii) Arrow facing E to SE (1) [1]

(d) Collapse with weight – ash does not fall off
Particularly when mixed with water
Pollution of the water supply- acidifying
(max 2 marks) [2]

(e) Holistic
Tsunamis explained
Depressurising the system could lead to eruption (e.g Mt St Helen's)
Long term instability
Coastal and ecosystem damage [3]

Total 13 marks

Q.2 (a) Normal / dip-slip (1)
Tensional extension / Hanging wall is downthrown (1) [2]

(b) (i) 75 – 15 = 60 (accept 55 - 65) (1)
$60/2 = 30$ cm yr^{-1} (1) [2]

(ii) Good (1)
Faster rate (1) when winter rainfall is above 210 mm (1)
Vice versa
(max 2 marks) [2]

(c) Holistic
Geology (permeable sandstone / impermeable shale) - ref to rock strength
Rainfall above 210 – more pore pressure
Erosion of the toe
Fault – vibration or associated with water
(Accept weathering / load / slope if qualified with ref to the diagrams, do not accept dip of beds)
(2 plus 2) [4]

(d) One described:
surface mapping
creep / strain measurement
groundwater pressures
micro seismic
borehole distortion
tiltmeter / pressure cells
electronic distance measurement
photosurvey
Other
(max 2 marks) [2]

Total 12 marks

Q.3 (a) *Describe the factors that affect the level of intensity of an earthquake measured on the modified Mercalli scale.*

Intensity defined
Earthquake size
Depth
Distance from epicentre
Local ground conditions - liquefaction
Case studies [10]

(b) *Explain how two of the following methods may be used to predict a major earthquake.*

Essentially you can't predict earthquakes only forecast

(i) *Electrical resistivity*

Measured by passing electric current through ground - measures conductivity / amount of groundwater containing ions.
Wenner arrays of four electrodes used to measure lateral and vertical changes in resistance of ground to electrical current.
Drier the more resistant and vice versa.
During build-up of elastic strain prior to earthquake (dilation) cracks open – water fills cracks (water better conductor than rock / air) thus decrease recorded
(max 7 plus 1)

(ii) *Earthquake lights*

Lights sometimes occur before, during and after earthquakes, thus of limited use, serve as warning precursors.
Described as
auroral streamers diverging from a point on the horizon;
beams like those from a searchlight;
sheets or circular glowing regions, touching the ground or in clouds above.
Piezoelectric effect. Certain materials, including quartz, respond to changes in pressure by changes in electrical voltage across their surfaces. As quartz-bearing rocks are stressed, they might produce such high voltages that lightning-like discharges could occur in the air above.
Small pockets of trapped natural gas are released and ignited by friction. These burning balls of gas then rise in the air and create the effect of the lights.
Pressure generated during earthquakes may cause water molecules to separate into atoms of hydrogen and oxygen, then quickly recombine back to water. In the process they theoretically could release light and create the mysterious earthquake lights.
Examples: Kobe, Longdendale valley.
(max 7 plus 1)

(iii) *Seismic activity*

Reference to:
Variation in the seismic rate. Increase in the background rate of minor earthquakes prior to a major quake. Seismic gap.
The measurement of the velocities of P and S waves passing through an area.
Reduction indicates influx of water into rock as micro-fractures open. On returning to normal, pore pressure rises = quake.
Rate of return to normal = Prediction of timing imminent.
Duration of anomaly = predicted magnitude of quake.
(max 7 plus 1) [15]

Total 25 marks

Q.4. (a) *Describe the geological hazards that may result when engineering activities associated with a major construction project interfere with natural processes in coastal areas.*

Holistic approach.
Problems of interference with coastal systems - erosion / deposition
Engineering activities include coastal defences (groynes, rip rap, sea walls etc)

Hazards - Coastal deposition – longshore drift pattern changed in unprotected areas
Reduction in amount of sediment deposition available to provide a beach to protect the coast.
Increased marine erosion in unprotected area.
Base of cliff undercut - loss of stability for toe of landslide etc - increase in mass movement
Increase lubrication of coastal sediments by sea water - mass movement
Reference to case studies credited. [10]

(b) *Explain the geological factors that need to be considered when selecting a suitable site for a dam and associated reservoir.*

Size & shape of valley and catchment	Long, narrow, deep to reduce evaporation
Rock strength of dam site	Suitable rock types explained. Clay / shale v limestone / sandstone / crystalline rock
Porosity and permeability of reservoir site	Leaking, need for grouting. Suitable rock types – shale / clay / crystalline rock
Structure	Fold / faults / cleavage (related to stability/seepage). Favourable and unfavourable features - sedimentation rates
Stability of site	Rock beneath, mass movement on sides. Earthquake risk
Examples	Credited

Holistic approach [15]

Total 25 marks

Q.5 (a) *Account for the presence of high concentrations of radon gas in buildings in some areas of the UK.*

Radon defined.
Natural release from radioactive decay.
Sources and pathways.
Granite - high risk areas (SW England).
Radon dissolves in water and transported in groundwater.
Released when pressure drops/near surface.
Trapped by some rock types (clay) but released to atmosphere to be trapped by poorly ventilated/well insulated buildings (cellars, attics, roof and floor voids). [10]

(b) *Explain how the foundations of large structures can be affected by:*

unstable patterns of geological structures (e.g. bedding, jointing, faulting, cleavage;
and
depth to the water table and rockhead.

Unstable patterns of geological structures (e.g. bedding, jointing, faulting, cleavage):
Effect of dip of beds / cleavage.
Slope faces daylight.
Stable friction angles.
Fracturing of fault planes.
Density of joints.
Lubrication by water.
Case studies.
(max 7 plus 1)

Depth to the water table and rockhead:
Affect of water on stability - porosity v permeability.
Pore pressure,
rock type,
lubrication,
liquefaction in earthquake prone areas.
Effect of fluctuating water tables e.g. London.
Rockhead depth - defined.
Nature of the drift material on stability.
Need for high foundation strength.
Case studies. [15]

Total 25 marks

Geology AS

MARK BAND CRITERIA FOR AS 2012 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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