GCE MARKING SCHEME

SUMMER 2016

GEOLOGY GL4
1214/01

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.

GCE GEOLOGY GL4

SUMMER 2016 MARK SCHEME

1. (a) (i) Pillow lava (1)
Submarine/aqueous eruption (1) [2]

(ii) Bottom bed arrowed (**R**)
Wrong way up (1)
Evidence – sags up (1) rounded top faces down/vice versa (1)
(Correct arrow plus 2 max) [3]

(b) (i) Olivine at top/bottom (1)
Olivine-rich layer near top contact (1)
None in middle region (1)
Some associated with random peridotite (xenoliths) (1)
Credit numbers (1)
(Max 3 marks) [3]

(ii) Olivine first to crystallise/at higher temp (1)
Trapped in faster cooling chilled margins/unable to react back (1)
More dense than melt (1)
Sinks/cumulate/gravity settling/fractional crystallisation (1)
Sill is **overturned** in later tectonic activity (stated or implied)(**R**) (1)
(Max 4 marks) [4]

(c) Peridotite fragment labelled (1)
Xenolith (1)
Law of included fragments (1)
From deeper mantle (1)
Source rock must be older than 76 Ma (1)
(Max 3 marks) [3]

Total 15 marks

2. (a) State:

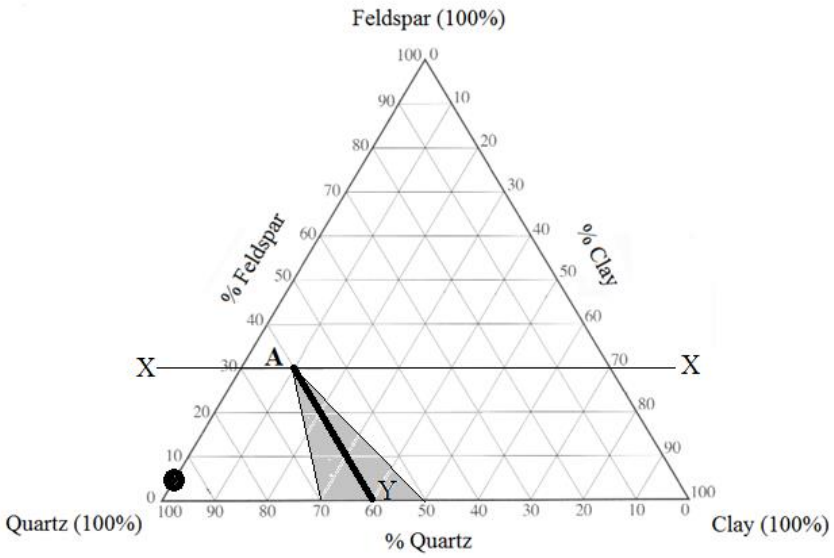
A	B	2 max
Texturally immature	Texturally mature	(1)
Larger/coarser clasts	Finer clasts	(1)
Has no cement/matrix	Has cement/matrix	(1)
Poor sorting	Well sorted	(1)
Angular/sub-angular	Sub-rounded / rounded	(1)

Explain: Degree of maturity explained in terms of:
More transport/erosion/weathering in **B** (1)
(credit terminology – abrasion/attrition)
For longer in **B** (1)
For further in **B** (1)
For larger number of erosion cycles (1)
(Or vice versa for **A**) (Max 2 marks)
Accept rate of deposition in **A** is more rapid (1)

(Must be clear from answer to which rock they are referring)
(Max 4 = 2+2) [4]

(b) (i) At quartz 95%, feldspar 5% [1]

(ii) Line (any length) drawn below line **X–X** (1)
Line (any length) drawn along **A–Y** (1)
Accept in grey area (2)
(accept alternative if stated that clay has been removed in (iii)
(Max 2 marks) [2]



(iii) Feldspar broken down by weathering (to clay) (1)
Increase in clay (1)
Hydrolysis of feldspar (1)
Greater mineralogical maturity (1)
Clay not transported (accept ref to clay being removed as in (ii)) (1)
Quartz stable – little or no loss (1)
(Max 3 marks) [3]

(c) **A** = Semi-arid river (alluvial fan) (1)

B = Beach (marine) (1) [2]

(d) FIRST
Burial & compaction (1)
(Accept pressure solution) (1)
To produce silica cement surrounding sand grains (1)
(Max 1 mark)
THEN
Other pore spaces infilled by (1)
Calcite cement from percolating fluid (1)
(Max 1 mark)
Evidence
Calcite cement fills spaces between silica cement and original quartz grains (**R**)

(Max 3 marks) [3]

Total 15 marks

3. (a) (i) A. Low energy/low current – fine-grained (1)
random orientation shells (1)
articulated valves (1)
B. Marine – brachiopods are marine fossils/uniformitarianism (1)
(Max 2 marks – 1 each from A and B if qualified) [2]

(ii) Holistic
Evidence for life assemblage
Random orientation – not current orientated
Well preserved/whole and not broken/articulated - not transported
Evidence for death assemblage
Same size – sorted in transport
all same age – no juveniles
All same way up – possible current sorting
(Max 2 marks from either life or death)
(Max 3 marks in total) [3]

(b) (i) Long axis = 45 (1) (accept 44-46)
Ratio = 2.6 (1) (accept 2.5-2.7 plus follow through)
Credit comparison of ratios [2]

(ii) 15 (1) (accept 12–18) [1]

(c) (i) **A** or **G** [1]

(ii) **A** shortened along hinge axis/extended along short axis (1)
G extended along hinge/shortened along short axis (1) [2]

(iii) Incorrect analysis stated/implied (**R**)
There is crustal shortening but NW-SE
NW-SE compression/shortening (σ max) of long axis
Long axis shortened NW-SE with no shear (brachiopod **A**)
NE-SW extension (σ min) of long axis with no shear (brachiopod **G**)
Evidence from cleavage
Can't tell really – only two-dimensional surface
(Holistic – max 4 marks) [4]

Total 15 marks

4. (a) (i) Modern [1]

(ii) $\frac{600 - 500}{600} \times 100 = \frac{100}{600} \times 100$ (1)

~17% (accept 14% - 20%) (1)
end Permian (P-T) (1) [3]

(b) Life with hard parts had not yet developed/soft bodies
Only algae, bacteria and medusoids
Unfavourable preservation
Fossils destroyed with time (metamorphism, igneous activity, surface processes)
Fossils not yet found
Fossil evidence is biased/incomplete
(Holistic – max 3 marks) [3]

(c) (i) Increases when supercontinents break up (1)
Less after supercontinents form (1) [2]

(ii) Quite good/good/positive (1)
Higher diversity correlates with when continents are fragmented (1)
Tertiary highest despite the collision of India (1)
Credit relevant observations from Fig 4 (1)
(Max 2 marks) [2]

(iii) Holistic
Correlation does not mean causation
Majority of marine life is associated with continental shelf seas
More continental shelf sea
- more room for life to develop
- less competition for nutrients, light, environment etc.
- greater chance for diversification
- vice versa

However other factors also influence diversity (Mass extinction)
- bolide impacts
- volcanism
- sea level change
- rapid climate change

(Max 3 marks for/against) [4]

Total 15 marks

5. (a) Thickness – accept 100m -150 m (1)
Depth – accept 900 – 1000m (1) [2]

(b) (i) Marble (1)
Basalt (1) [2]

(ii) Dolerite is coarser/medium-grained (1) – slower cooling (1)
Or Lava cooled quickly (1) – fine-grained (1)
Baked margin above (1)
(Max 2 marks) [2]

(iii) Not linear outcrop (1)
Mainly concordant with beds (1)
BUT locally it cuts across/transgressive/discordant (**R**)
(Max 3 marks) [3]

(c) Holistic
Beds offset where sill transgresses from one bed to another
Could be along pre-existing faults/weaknesses
However - beds offset as sill has forced its way in across beds/along weaknesses
Sill is not affected by the Buckhaven Fault
Not all transgressions show beds displaced
(max 2 marks) [2]

Total 11 marks

6. (a) (i) Axis drawn correctly (1)
Plunge arrow to south (1) [2]

(ii) Anticline – oldest strata (PGP) in centre of fold (1)
Beds 'v' (close) to south in direction of plunge (1) [2]

(b) Axis of folds (Leven Syncline) not offset (1)
Tick on downthrown side indicates vertical movement (1)
Width of outcrop (PGP) differs on either side of fault (1)
(Max 2 marks) [2]

(c)

Buckhaven Fault characteristics	
Dip angle	varies with depth
Strike direction	• WSW – ENE (~080° – 260°) (accept W-E/SW-NE)
Downthrow side	• Southern/S/SE
Hanging wall	• southern/down
Fault type	• normal

[4]

(d) (i) 59 mm (accept 58) (1) × 40 = 232 – 236(1)
(Max 2 marks) [2]

(ii) Throw decreases with depth (1)
Comparative numbers (throw ~50m towards base) (1)
Dies out at ~1200m (1)
(Max 2 marks) [2]

(e) Holistic to reflect
Split seams
Coal Measures deeper because of folding/faulting/fault disruption/reactivation
Coal seam not laterally continuous – washouts etc.
Flooding beneath estuary
Effects of the sill and volcanic rocks
(Max 3 marks – only (1) **max** for generic answers – e.g. rock stability, gas, groundwater pollution, waste tipping etc.) [3]

Total 17 marks

7. (a) Shading
- associated with 1200m and **base** coal-bearing strata (1)
- parallel with the surface outcrop (1) [2]

(b) (i) Fractures/joints/cracks/cleavage/cleats (1)
vertical/horizontal – 90 deg (1)
breaks into blocks/cubes (1)
(Max 2 marks) [2]

(ii) Fracture = increased surface area for storage/porosity (1)
Fractures provide pathways for movement/permeability (1) [2]

(c) Holistic
Coal Measures are found above 1200 m along section
Passage group – devoid of coal (other than thin coals)
Leven Syncline plunging. Coal Measure may fall below 1200 m further south beneath the Firth of Forth – less access
ULGS – limited coal resources but below 1200 m
LSC – good potential (many coal seams and below 1200 m)
LLGS – limited coal resources but below 1200 m
Compression may have closed the fractures of coal
(Max 6 marks) [6]

Total 12 marks