# wjec cbac

# **GCE MARKING SCHEME**

**SUMMER 2017** 

GEOLOGY GL5 - THEME 3 1215/03

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## 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 GL5 THEME 3

# SUMMER 2017 MARK SCHEME.

1.	(a)	(i)	NE-SW; approx. 070-250 (1)	[1]
		(ii)	NNE to NNW (1)	[1]
		(iii)	found primarily in kyanite/silliminite zone metamorphic rocks <b>or</b> located to NE of area (1) 5 discrete plutons <b>or</b> quantification of size; up to 50km <b>or</b> statement on shape; equidimensional to ~E-W elongation (1) (max 2 marks)	[2]
		(iv)	found within higher grade (kyanite/silliminite) zone metamorphic rocks (1) these metamorphic rocks subjected to highest temperatures (1) (partial) melting has occurred (1) of the metamorphic country rocks (1) at a subduction/collision zone or destructive plate boundary (1) (max 3 marks)	[3]
	(b)	(i)	(sub-) vertical axial plane passing through hinges of synform (1)	[1]
		(ii)	anticline or overturned (1R) synform (1) upright (1) open/inter limb angle 70-85° (1) presence of parasitic folds (1) NE-SW trend (1) oldest rocks/Erins Quartzite in centre of fold (1) symmetrical (1) wavelength~20km (1) (max 3 marks, R+2)	[3]
	(c)	RocksGranites indicate (partial) melting at a destructive plate boundary (1)Metamorphic zones indicative of regional metamorphism/ high directedstresses (1)Presence of slates indicative of regional metamorphism/ high directedcompressive stresses (1)Age of granites concordant with Caledonian orogeny (1)(maximum 3 'rocks' marks)StructureFolding indicates high compressive stresses/ destructive plate boundary (1)Presence of reverse fault indicates compressive stresses/ destructive plateboundary (1)Metamorphic zones concordant with Caledonian trend (1)fold axes trend NE-SW concordant with Caledonian trend (1)folds formed by NW-SE stress also concordant with Caledonian trend (1)HBF trend NE-SW concordant with Caledonian trend (1)(maximum 3 'structure' marks)(maximum 4 marks)		
		ווישאוו	Total 15 ma	ر تا arks

- 2. (a) Describe how sedimentary rocks and their contained fossils can be used to interpret shallow marine environments of deposition.
  - (b) 'The lower Palaeozoic sedimentary rocks of the British Isles were deposited in deep marine environments'. Evaluate this statement.

Description.

Shallow marine environments = may be clastic and/or carbonate.

Clastic = conglomerates/ sandstones (orthoquartzite)/ silts-mudstones with cross bedding/ wave ripples/laminations. Fossils to include trilobites/ bivalves/ brachiopods/ traces etc. Discussion of palaeoecology of these groups.

Carbonate = various limestones (e.g. oolitic, bioclastic) with similar sedimentary structures and fossils perhaps with more corals/ crinoids depending on climate.

Evaluation.

Widespread deep marine sediments present in lower Palaeozoic on both sides of lapetus e.g. Welsh Basin Aberystwyth Grits and Moffat Shales of the Southern Uplands. However the lower Palaeozoic also contains excellent examples of shallow marine (e.g. Cambrian shelf facies of Harlech and Ordovician-Silurian Anglo-Welsh 'brachiopod province' of the Welsh Basin; Wenlock Limestone) and even non-marine sequences e.g. (basal sections of ORS).

**Total 25 marks** 

[25]

- 3. (a) Describe the evidence for rifting and subsidence in the North Sea area during the Mesozoic.
  - (b) Evaluate the evidence in the British Isles for the opening of the Atlantic Ocean during the Tertiary.

[25]

#### Description

Primary lines of evidence comes from seismic data/ boreholes/ petrophysics/ gravity/ comparison with onshore data.

Structural evidence (plentiful): large scale normal faulting, E-W tension, formation of graben and half-graben, e.g. Viking Graben, Moray Firth, Central Graben, onset in Triassic, most significant rifting in mid-late Jurassic, themal subsidence in Cretaceous, rifting due to linkage with propagating Artic and Central Atlantic rift systems. Picture confused by Tertiary (Alpine) inversion and reactivation especially in southern North Sea.

Igneous evidence (limited): evidence for mid-Jurassic volcanism including basalts/ agglomerates and tuffs possibly associated with mantle plume induced rifting event, analogue being East African Rift Valley.

Sedimentary evidence (plentiful): very thick Triassic to Cretaceous sequences deposited in subsiding rift basins, Triassic = arid non-marine environments-evaporites/deserts/flash floods, Early-Mid Jurassic = shallow seas/ deltaic environments, Upper Jurassic- Early Cretaceous = anoxic deep sea/ turbidites, Late Cretaceous = chalk deep sea.

Evaluation

Abundant igneous activity in NW Britain.

Range of bodies: Flood basalts, plutons - granitic and gabbroic, dyke swarms, sills.

Range of rock types. Basaltic volcanic activity and associated gabbroic and granitic centres. Mantle plume develops beneath northwest UK and Greenland.

Rifting and development of spreading centre, opening of North Atlantic. Large volume of (flood) basalt associated with mantle plumes.

Hot spot trail to Iceland. Mid ocean ridge still active. Evidence of tension (dykes etc).

Later granitic intrusions due to melting of continental crust.

Total 25 marks

4. 'The effects of the Variscan and Alpine orogenies can be found in England and Wales'.

Describe and evaluate the geological evidence which supports this statement.

[25]

### Description

Variscan Widespread structural evidence including:

Thrusting along the Lizard Thrust Zone and Tight vertical / overturned folding with E-W trend in SW England and South Wales. Folding less intense to north where different trends exist e.g. Pennines N-S.

Some reactivation of Caledonian structures.

Widespread igneous evidence including: Cornubian granites and associated minor intrusions. Paucity of such evidence in south Wales. Activity in north e.g. Whin Sill associated with gravitational collapse. Obducted ophiolites - Lizard.

Limited metamorphic evidence including: Low to medium grade metamorphism limited to SW England.

Alpine

Widespread structural evidence most prevalent in southern England.

Gentle folding on margin of orogenic belt.

Wealden Dome separating London and Hampshire Basins. IOW-Purbeck-Weymouth line. Monoclinal folding with vertical northern limb. E-Wtrend.

Fault reactivation.

However no metamorphism. No significant igneous activity.

#### **Evaluation**

Convincing evidence for Variscan especially in SW with association of deformation, metamorphism and intrusion. Continuous with northern Europe. However less evidence further north. Except for structural evidence there is little additional evidence of Alpine orogeny - need to look elsewhere. Margins of orogenic belt.

Total 25 marks

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