Surname	Centre Number	Candidate Number
Other Names		2

GCE AS/A level

1211/01

GEOLOGY – GL1
Foundation Unit

P.M. TUESDAY, 14 January 2014

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**17**	
2.	**11**	
3.	**14**	
4.	**18**	
Total	**60**	

1211
010001

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:
- the Mineral Data Sheet;
- a calculator.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded that marking will take into account the use of examples and the quality of communication used in your answers.

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Answer **all** *questions*.

1. **Figure 1a** is a cross-section through a sill formed by the intrusion of two igneous bodies composed of rocks **A** and **B**. **Figure 1b** shows the variation in crystal size of the groundmass through the igneous bodies. **Figure 1c** shows a sample of rock **A** collected from locality **A** on **Figure 1a**.

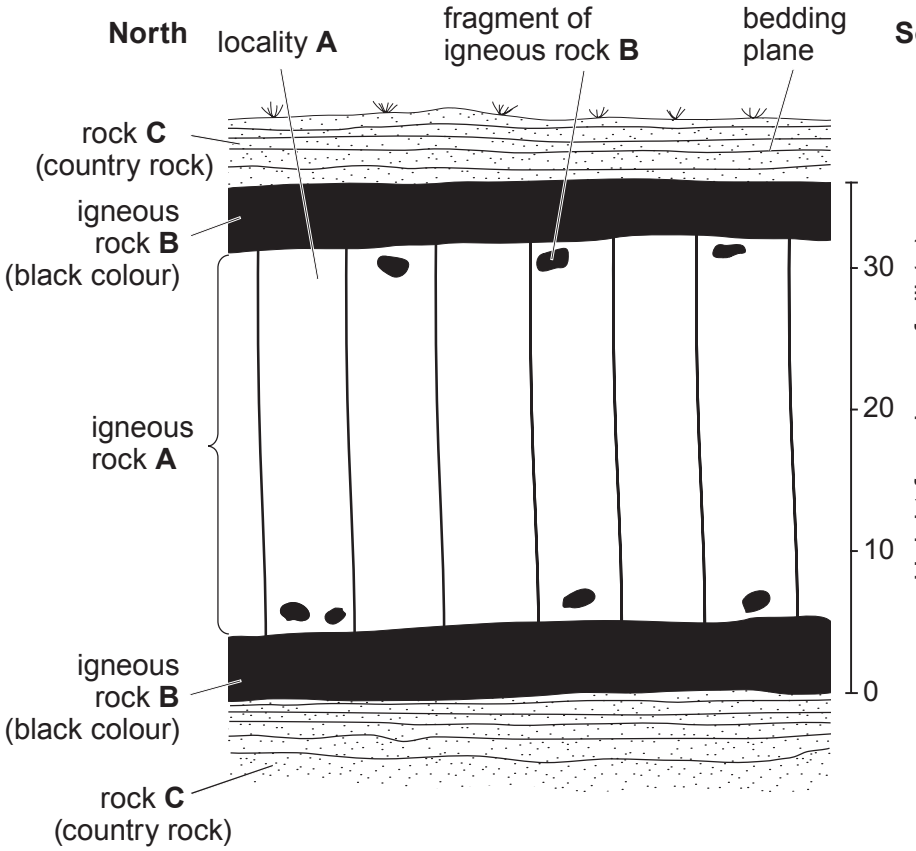


Figure 1a

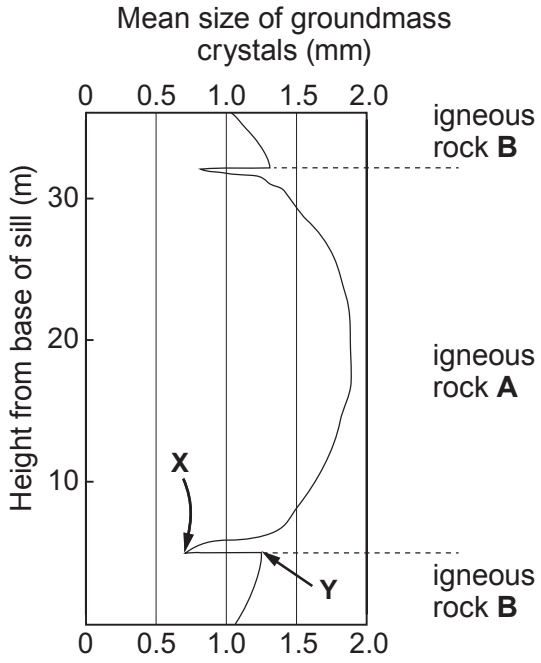
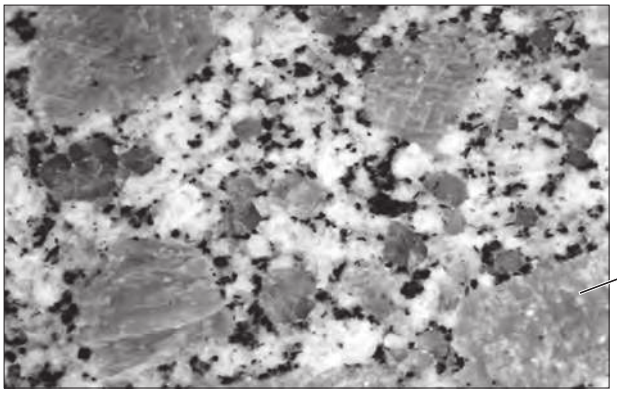


Figure 1b



igneous rock **A**

mineral **P**
- pink colour
- vitreous lustre

0 4
mm

Figure 1c

Examiner only

(a) Explain why the igneous bodies in **Figure 1a** have been correctly identified as forming a sill rather than a dyke. [1]

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.....

(b) Refer to **Figure 1b**.

(i) Describe the variation in crystal size of the groundmass in igneous rock **A only**, shown on the graph **Figure 1b**. [2]

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.....

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(ii) Explain the variation in crystal size of the groundmass in igneous rock **A only**, shown on the graph **Figure 1b**. [2]

.....

.....

.....

(iii) With reference to igneous rocks **A** and **B** explain the difference in crystal size between the points labelled **X** and **Y** on **Figure 1b**. [2]

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(c) Refer to **Figure 1c**.

(i) Identify mineral **P** in **Figure 1c**. You may wish to refer to the mineral data sheet. [1]

Mineral **P** .....

(ii) Describe the texture of igneous rock **A** in **Figure 1c**. [3]

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Turn over.

Examiner only

(d) Refer to **Figures 1a** and **1b**.

Name igneous rock **B**. Give reasons for your answer. [3]

Name of igneous rock **B** .....

Reasons .....

.....

.....

(e) Complete **Table 1** by adding the letters **A**, **B** and **C** to show the relative ages of the three rocks in **Figure 1a**. Explain how you used the evidence in **Figure 1a** and **Figure 1b** for your answer. [3]

	Rock
youngest	•
	•
oldest	•

Table 1

Explanation of evidence

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Examiner only

2. **Figure 2a** shows the velocity curves of two types of seismic wave in the continental crust and upper mantle. **Figure 2b** is a map showing four localities **E**, **F**, **G** and **H**.

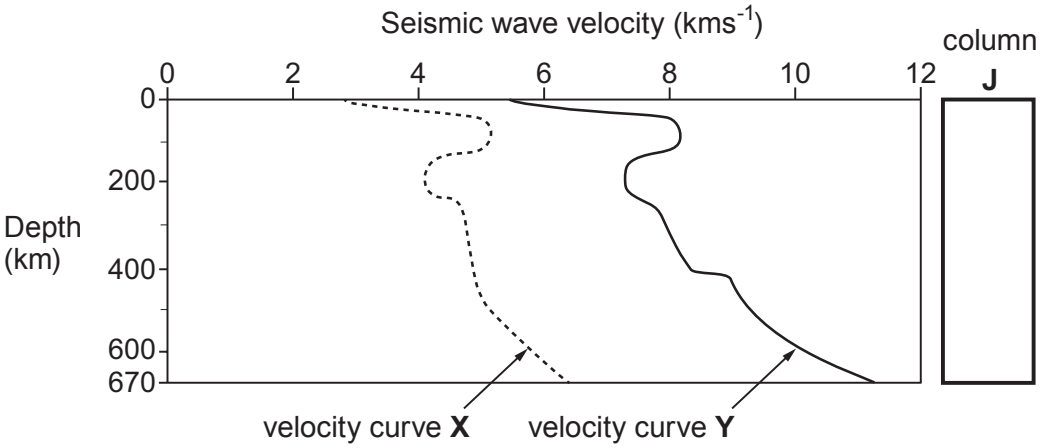

Figure 2a

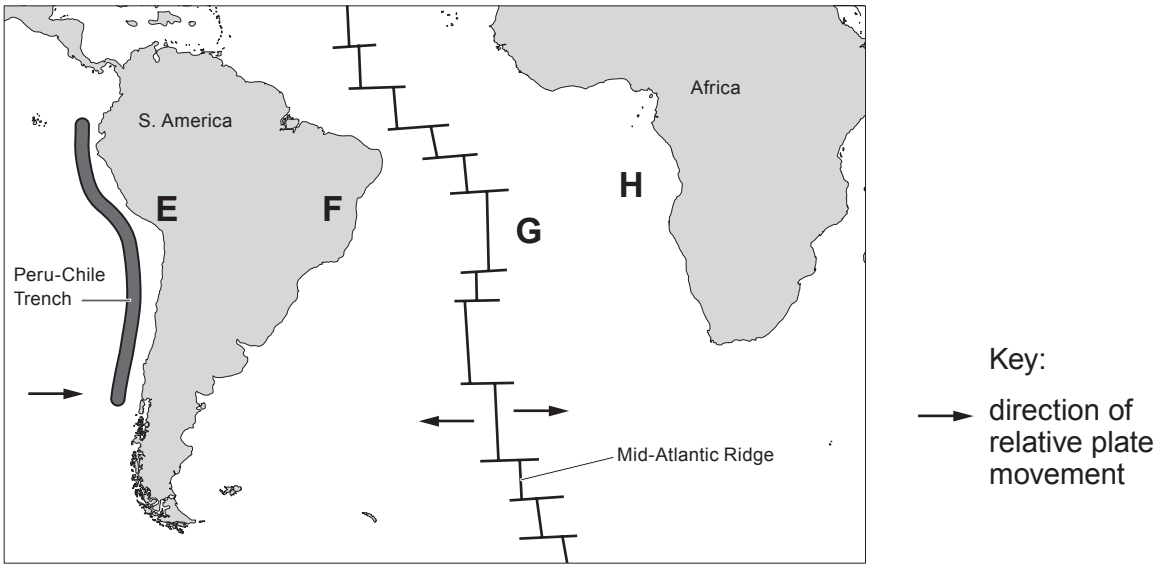

Figure 2b

(a) Identify which type of seismic wave, P, S or surface, is represented by velocity curve **Y** on **Figure 2a**. Give reasons for your choice. [3]

Type of wave .....

Reasons .....

.....

.....

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(b) Refer to **Figure 2a**.

(i) Mark in the blank column **J**, with an arrow labelled **A** (◄— **A**), a location within the asthenosphere. [1]

(ii) Explain why the velocity of the seismic waves is relatively low at a depth of 200 km. [2]

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(c) Refer to **Figure 2b**.

For each pair of locations below, state at which locality the **crust** is **thicker**. In each case explain your answer.

(i) Locality **F** and Locality **H** [1]

Thicker crust at locality .....

Explanation .....

.....

.....

(ii) Locality **E** and Locality **F** [2]

Thicker crust at locality .....

Explanation .....

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.....

(iii) Locality **G** and Locality **H** [2]

Thicker crust at locality .....

Explanation .....

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Turn over.

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3. **Figure 3a** is a geological map. **Figure 3b** shows rock **K** collected from the solid geology within the area shown on **Figure 3a**.

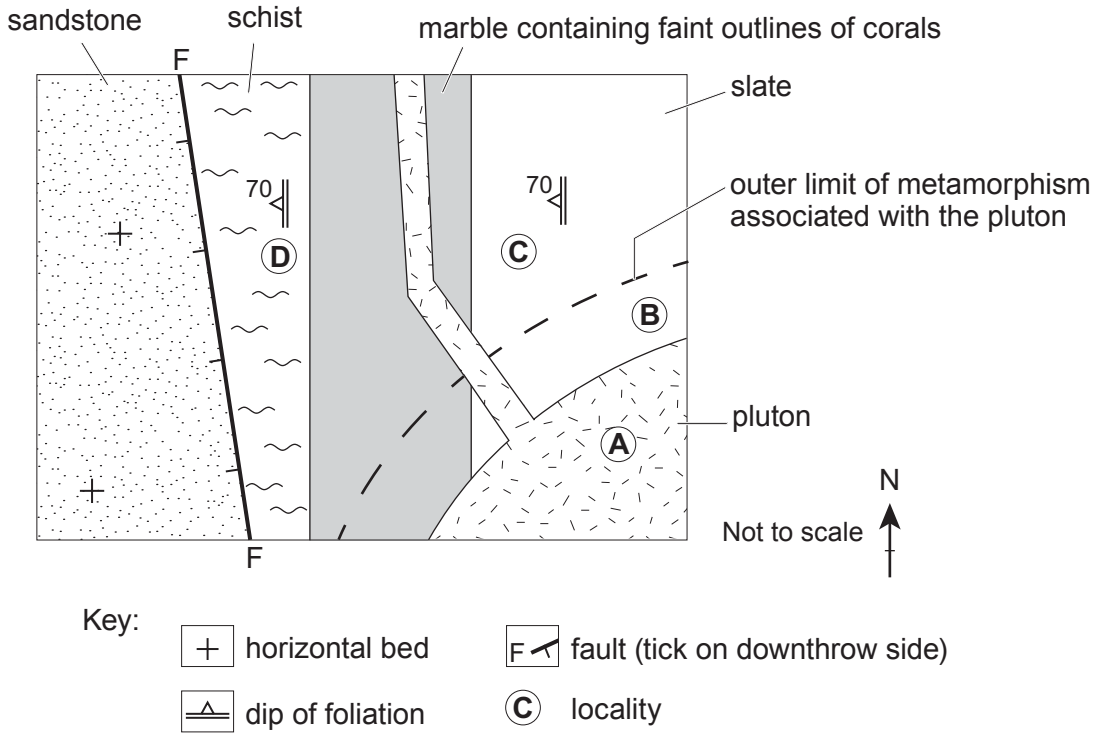

Figure 3a

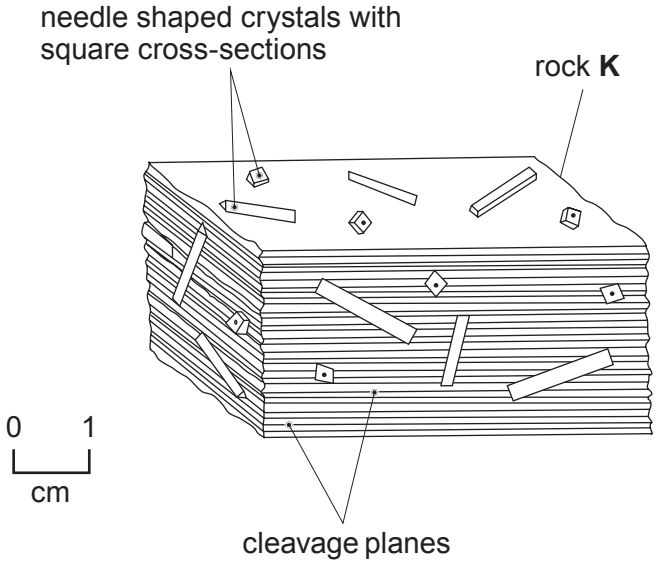

Figure 3b

Examiner only

(a) Refer to **Figure 3a**.

(i) Mark with an arrow on **Figure 3a** the direction towards which the effects of **regional** metamorphism increase. [1]

(ii) Explain why the sandstone has not undergone metamorphism although the schist alongside it has. [2]

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(b) Refer to **Figure 3b**.

(i) Explain the origin of the cleavage planes in rock **K**. [3]

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(ii) Tick **one** box below to select the most likely locality **A**-**D** in **Figure 3a** from which rock **K** was collected. Give reasons for your answer. [3]

Location **A** ☐ **B** ☐ **C** ☐ **D** ☐ Tick **one** box only

Reasons .....

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Examiner only

(c) Draw in **Figure 3c**, using the scale provided, the texture of a sample of marble with mean crystal size 1.5 mm. [2]

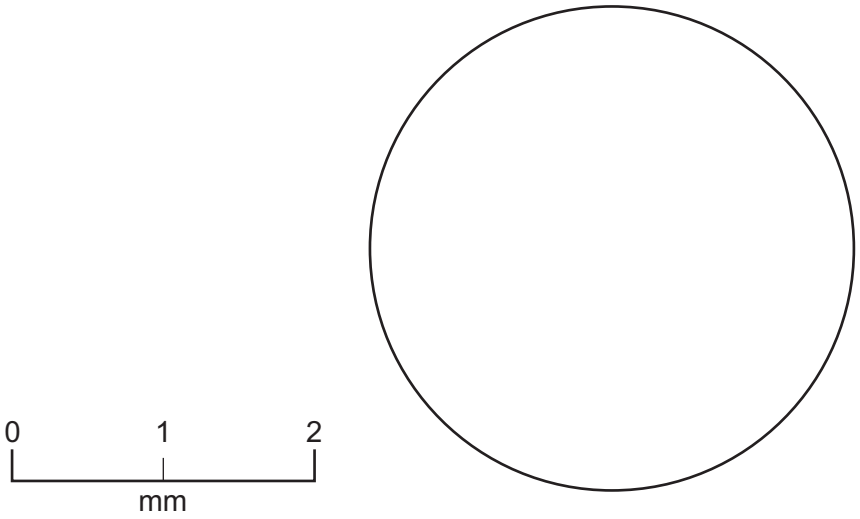

Figure 3c

(d) It has been suggested that the area shown in **Figure 3a** was "once a shallow tropical sea into which lavas erupted". Evaluate this statement giving reasons for your answer. [3]

Evaluation .....

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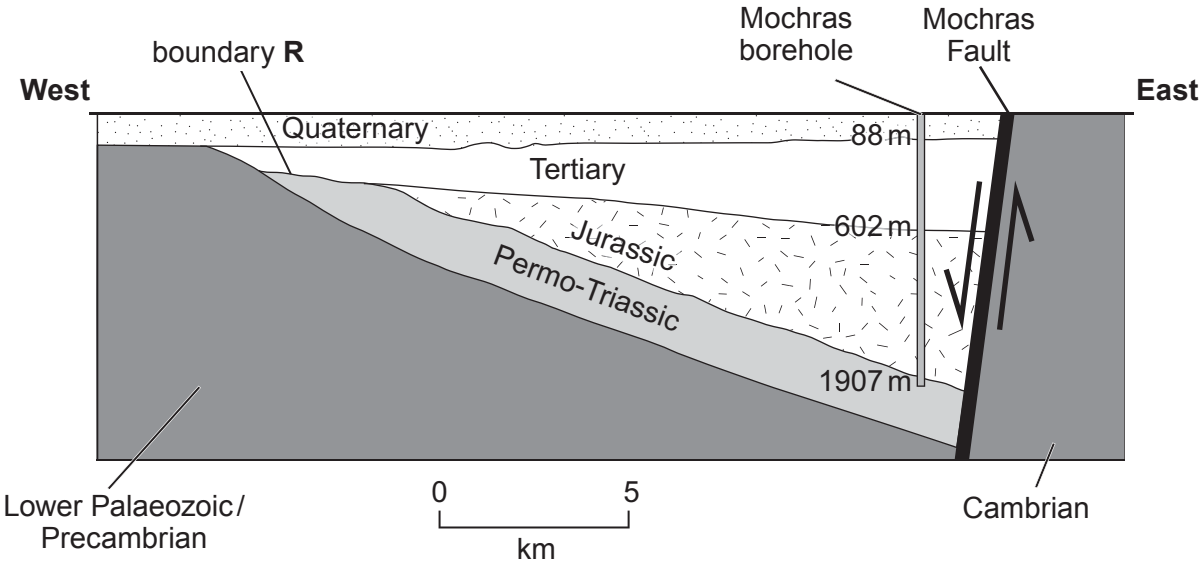
4. **Figure 4a** is a cross-section of the geology of an area of western Wales. **Figure 4b** is the Geological Column.



Data shown within the borehole represent approximate depths from the surface and are not drawn to scale.

Figure 4a

Date (million years)	Period	Era
	QUATERNARY	CENOZOIC
2.6	TERTIARY	
66	CRETACEOUS	MESOZOIC
145	JURASSIC	
201	TRIASSIC	
252	PERMIAN	PALAEOZOIC
299	CARBONIFEROUS	
359	DEVONIAN	
419	SILURIAN	
443	ORDOVICIAN	
485	CAMBRIAN	
541	PRECAMBRIAN	

Figure 4b

Examiner only

(a) (i) The downthrow side of the Mochras Fault in **Figure 4a** has been indicated to the west of the fault. With reference to **Figures 4a** and **4b** state the evidence that could have been used to conclude that the downthrow side of the fault is to the west. [2]

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(ii) State the type of fault movement (normal, reverse, thrust, strike-slip) shown by the Mochras Fault in **Figure 4a**. Give a reason for your answer. [2]

Type of fault movement .....

Reason .....

.....

.....

(b) (i) State the thickness of the Cenozoic rocks in the Mochras borehole in **Figure 4a**. [1]

..... metres

(ii) Explain why the throw of the Mochras Fault cannot be determined from the information in **Figure 4a**. [1]

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Turn over.

Examiner only

(c) (i) Indicate with an arrow labelled **U** (◄— **U**) on **Figure 4a**, the position of an unconformity formed less than 10 million years ago. [1]

(ii) With reference to **Figures 4a** and **4b** describe **three** pieces of evidence which indicate that geological boundary **R** on **Figure 4a** represents a break in the geological record. [3]

1. .....

.....

2. .....

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3. .....

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Examiner only

Figure 4c shows fossil **M** collected from the Quaternary deposit shown in **Figure 4a**.

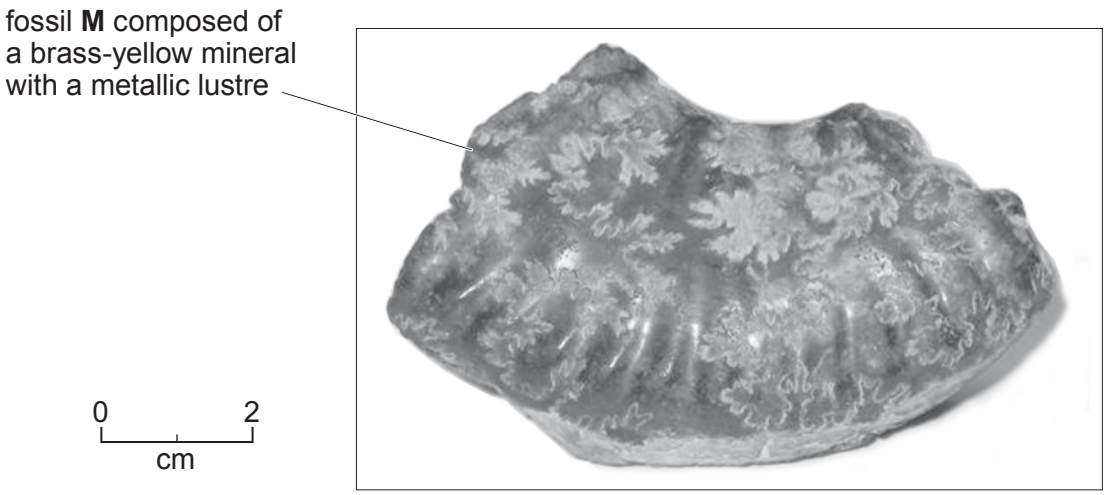

Figure 4c

(d) Refer to **Figure 4c**.

(i) Explain how the fossil has been preserved by a mineral with a different composition to the original shell. You may wish to refer to the Mineral Data Sheet. [3]

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(ii) Identify the group to which fossil **M** belongs. Give a reason for your choice. [2]

Fossil group .....

Reason .....

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(iii) Evaluate the use of fossil **M** in determining the environment of deposition of the Quaternary deposit in which it is preserved. [3]

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END OF PAPER

Acknowledgements

Figure 1c wildabouttheworld.com

Figure 2a tankongvtar.hu

Figure 4a www.geologywales.co.uk

Figure 4c svt premiere.s.free.Fr

GCE AS/A level

1211/01-A

GEOLOGY
MINERAL DATA SHEET FOR USE WITH GL1

January 2014

Name		Cleavage/Fracture	Hardness	Density g cm^{-3}	Streak	Lustre	Colour	Other diagnostic properties
Quartz	RF	*none/conchoidal	7	2.65	scratches streak plate	vitreous	colourless, milky but variable	hexagonal prisms terminated by pyramids
Orthoclase Feldspar	RF	*2 good, 90	*6	2.6	scratches streak plate	vitreous	flesh, pink, white	*simple twin
Plagioclase Feldspar	RF	*2 good, 90	*6	2.7	scratches streak plate	vitreous	creamy-white, grey, colourless	*repeated multiple twin
Muscovite Mica	RF	*1 perfect (basal)	*2.5	2.7-3.1	white	pearly	colourless or pale yellow, green or brown	*flaky
Biotite Mica	RF	*1 perfect (basal)	*2.5-3	2.7-3.1	white	pearly	brown/black	*flaky
Hornblende	RF	*2 good, 60/120	*5-6	3.0-3.5	scratches streak plate	vitreous	black, dark green	prismatic crystals
Augite	RF	*2 good, 90	*5-6	3.2-3.5	scratches streak plate	vitreous	greenish black	prismatic crystals
Olivine	RF	none/conchoidal	*6-7	3.2-4.3	scratches streak plate	vitreous	*olive green	
Chiastolite/ Andalusite		poor 1/ uneven fracture	7.5	3.1-3.3	scratches streak plate	vitreous	pearly grey/pink	needle crystals with square x-sections, black centre
Garnet		none	*6.5-7.5	3.5-4.3	scratches streak plate	vitreous	red/brown	*12 sided crystals - each face rhomb shaped
Chlorite		1 good (basal)	*2	2.6-2.9	white	pearly	green	fibrous/flaky as massive, tabular crystals
Calcite	RF	*3 good, not at 90, perfect rhombs	*3	2.71	white	vitreous	colourless, white, tints	*effervesces with 0.5M HCl, rhombic shape
Fluorite		*4 good, parallel to octahedron	*4	3.0-3.2	white	vitreous	colourless purple/green/yellow	fluoresces in uv light, cubic or octahedral crystals
Halite		3 good, 90 cubic	*2.5	2.2	white	vitreous	colourless, white, often stained	*salty taste, cubic crystals, often stained
Gypsum		1 good (basal)	*1.5-2	2.3	white	silky, pearly	colourless, white, often stained	fibrous or twinned crystals
Barites		2 good, 90	*3-3.5	*4.5	white	vitreous, resinous	white, pink	bladed crystals
Chalcopyrite		poor/conchoidal	4	4.2	*black	metallic	bronze yellow	*tarnished to peacock colours
Pyrite		none/conchoidal	*6	5.0	*greenish black	metallic	brass yellow	crystals often striated cubes
Galena		*3 good, 90 cubic	*2.5	*7.5	*lead grey	metallic	lead grey	cubic crystals
Haematite		poor/subconchoidal	*5.5-6.5	4.9-5.3	*cherry red	metallic-dull	red/black skin/steel grey	kidney shaped masses, fibrous

* - Useful property for diagnosis RF - Common rock-forming mineral

This table should not be memorised.
Marks in the examinations will be awarded for description of the outcomes of tests on minerals and, on some occasions, identification from test results.