Surname	Centre Number	Candidate Number
Other Names		2

GCE AS/A level

1213/01

GEOLOGY – GL3
Geology and the Human Environment

A.M. WEDNESDAY, 22 May 2013

1¼ hours

			Examiner only
Section A	1.	13	
	2.	12	
Section B	3.	25	
	4.		
	5.		
Total		50	

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ADDITIONAL MATERIALS

In addition to this examination paper, you will need 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 from Section **A** and **one** from Section **B**.
Write your answers 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.
Candidates are reminded that marking will take into account the use of examples and the quality of communication used in answers, especially in the structured essay.

SECTION A

Answer **both** *questions* **1** *and* **2** *on the lines provided in the questions.*

1. **Figure 1a** shows the geology of Lake Nyos in Cameroon, situated on the flank of an inactive volcano. **Figure 1b** shows a natural rock dam on the flank of Lake Nyos. **Table 1** provides details of a disaster that occurred in 1986.

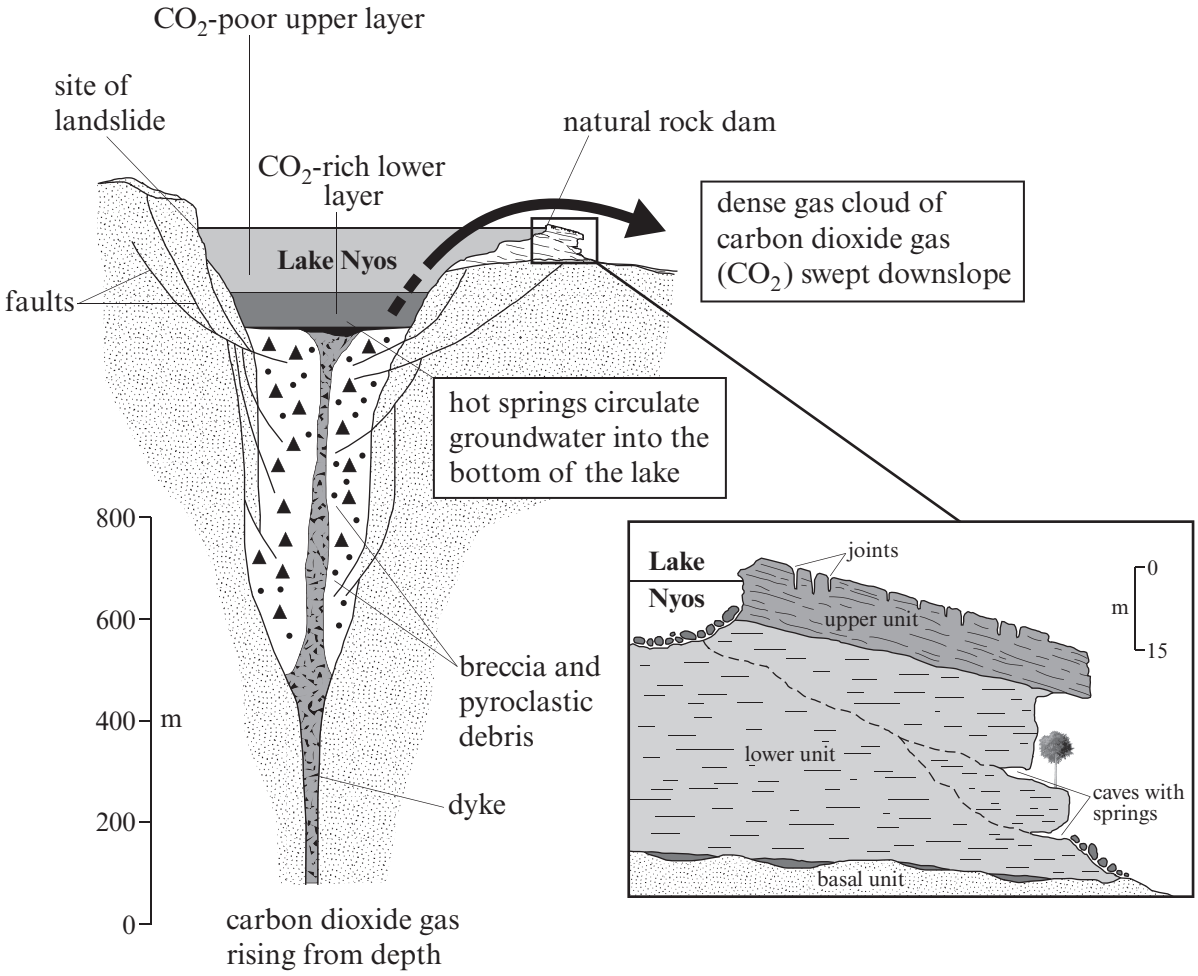

Figure 1a **Figure 1b**

Source: http://records.viu.ca/~earles/nyos-feb01.htm

Table 1

During the night of 26th August 1986, a cloud of carbon dioxide gas (CO_2) from Lake Nyos killed more than 1700 people and livestock in villages up to 25 km away from the lake. Many died in their sleep. Scientists believe that the carbon dioxide-rich waters at the bottom of the lake were disturbed, perhaps by a landslide.

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(a) Refer to **Figure 1a** and **Table 1**.

(i) Estimate the maximum depth of Lake Nyos on **Figure 1a**. [1]

..... metres

(ii) State **two** pieces of evidence that indicate Lake Nyos is a **volcanic** lake. [2]

1. .....

2. .....

(b) (i) Explain how carbon dioxide gas might become trapped in the deep waters of Lake Nyos. [2]

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(ii) Explain how a landslide into Lake Nyos may have resulted in the release of carbon dioxide gas at the surface. [2]

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(iii) Explain how the properties of carbon dioxide made the gas extremely dangerous in this situation. [2]

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(c) **Figure 1b** shows that the surface waters of Lake Nyos are held in place by a natural dam of volcanic rock.

Explain how the **evidence** supports the view that this natural dam could collapse in the near future (estimated 10-20 years) causing further risk to life and property. [4]

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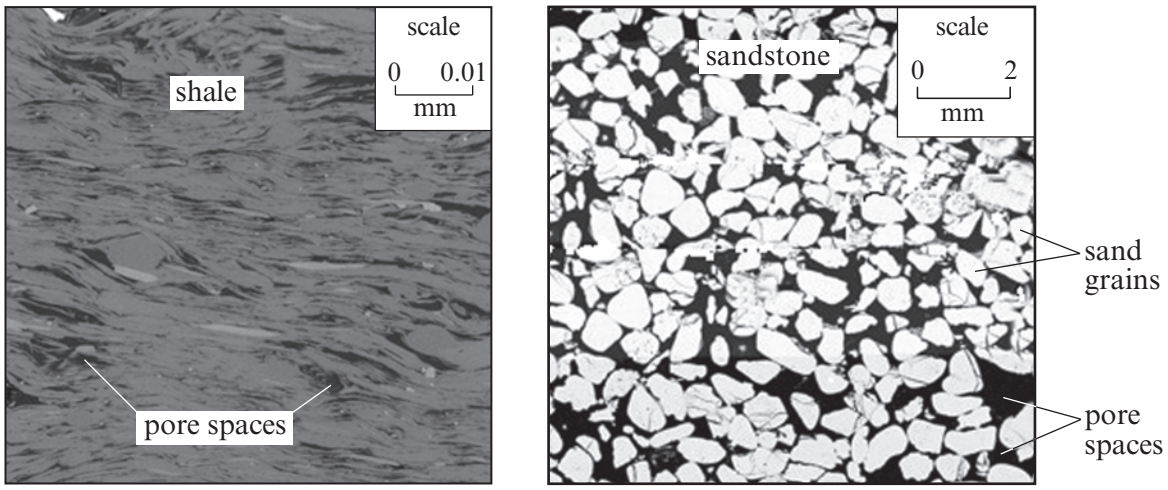
2. **Figure 2a** shows the texture of a shale and a sandstone. **Figure 2b** shows the process of hydraulic fracturing (fracking) used to obtain natural gas from shale.



Note: shale and sandstone are shown at different scales

Figure 2a

Sources – adapted from http://www.bbc.co.uk/news/uk-england-lancashire-15550458
http://www.fei-natural-resources.com/oil-gas/porosity-permeability.aspx:
http://sp.lyellcollection.org/content/289/1/19/F3.expansion

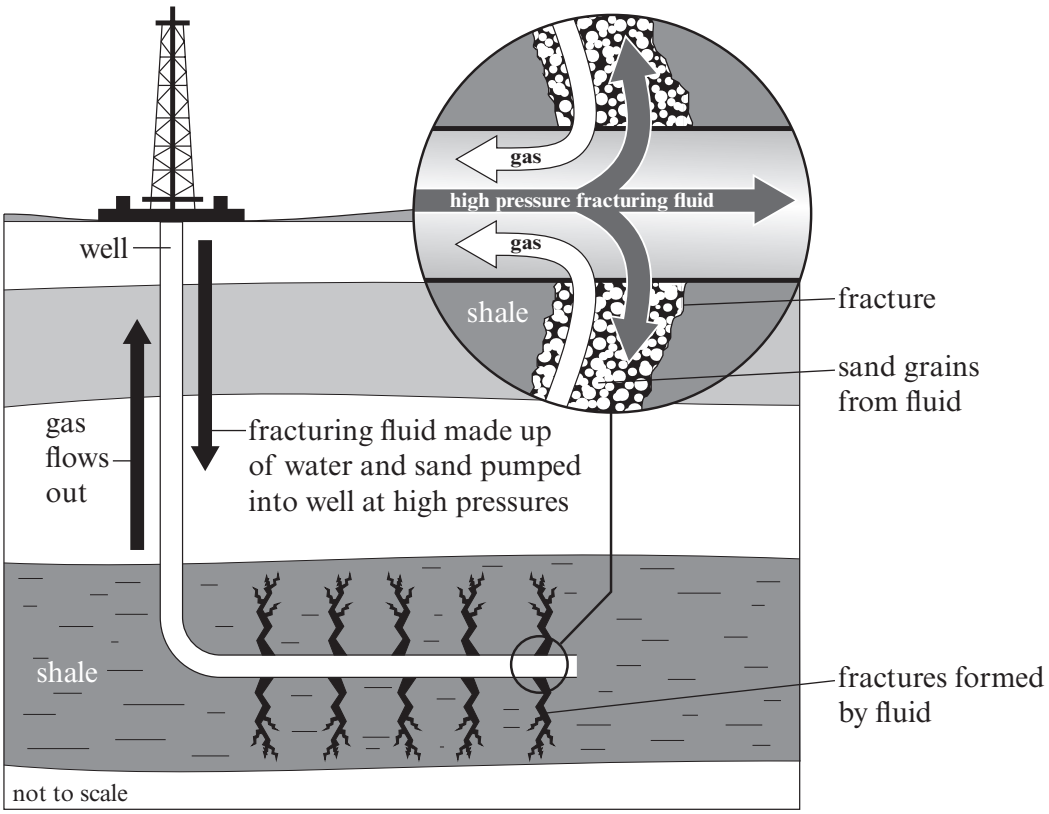


Figure 2b

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(a) Both shale and sandstone are porous.

(i) Define *porosity*. [2]

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(ii) With reference to **Figure 2a**, explain why the flow rate of fluids through shale is typically much lower than through sandstone, despite both rocks having similar porosities. [2]

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(b) Explain how the fracturing fluid (water and sand) in **Figure 2b** is used in the extraction of natural gas from shale. [3]

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QUESTION 2 CONTINUES ON PAGE 6

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(c) Refer to **Table 2**.

Table 2

In April and May of 2011 two earthquakes, with magnitudes of 2.3 and 1.5, were recorded near Blackpool. Both occurred close to the Preese Hall drilling site, where hydraulic fracturing (fracking) was being used to extract natural gas from shale. A report has confirmed that fracking is likely to have caused the earthquakes.

(i) Explain how the fracking process may have been responsible for triggering the earthquake events in Blackpool. [3]

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(ii) Describe and explain the likely level of damage caused by these earthquakes on built structures in the Blackpool area. [2]

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SECTION B

Answer **one** *question from this section on the following pages.*

The marks you will be awarded in your essay take into account:
evidence of geological knowledge and understanding;
the use of geological examples;
legibility, accuracy of spelling, punctuation and grammar;
the selection of an appropriate form and style of writing;
the organisation of material, and use of geological vocabulary.

EITHER,

3. *(a)* Outline the social and economic benefits and limitations of attempting to predict earthquakes. [10]

(b) Using one or more case studies, explain how the destructive effects of earthquakes can be managed and controlled to reduce risk. [15]

OR,

4. *(a)* Describe the potential hazards associated with lava flows and explain how the risk to life and property often depends upon the composition of the magma. [10]

(b) Using one or more case studies, explain how the risk to life and property associated with a major volcanic event largely depends upon the extent to which the eruption can be predicted or its effects minimised. [15]

OR,

5. *(a)* Using diagrams, describe how the stability of working faces, associated with the extraction of rock and minerals, may reflect the friction angle and presence of rock disconformities. [10]

(b) Explain the methods that may be used to monitor potentially unstable slopes. [15]

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