Surname	Centre Number	Candidate Number
Other Names		2

GCE AS/A level

1213/01

GEOLOGY – GL3
Geology and the Human Environment

A.M. WEDNESDAY, 23 January 2013

1¼ hours

			Examiner only
Section A	1.	12	
	2.	13	
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 graphs indicating the total subsidence recorded along two transects (**A–A′** and **B–B′**) over a two year period in a coal mining area of the English Midlands. **Figure 1b** is a cross section of the two transects.

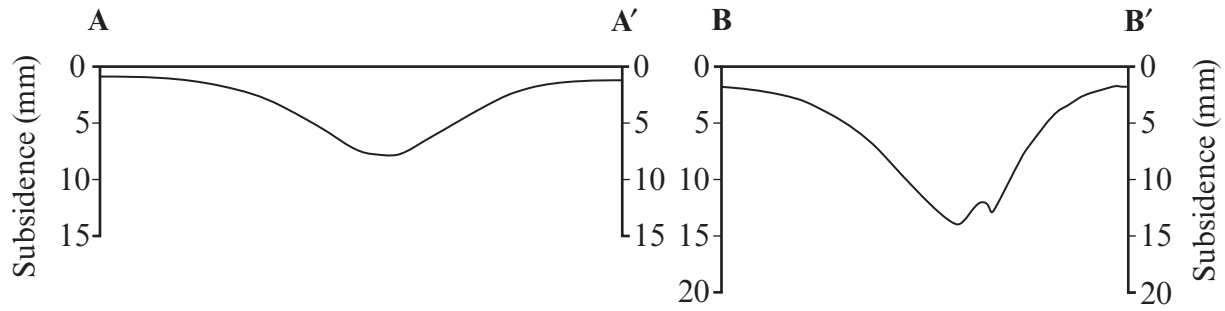

Figure 1a

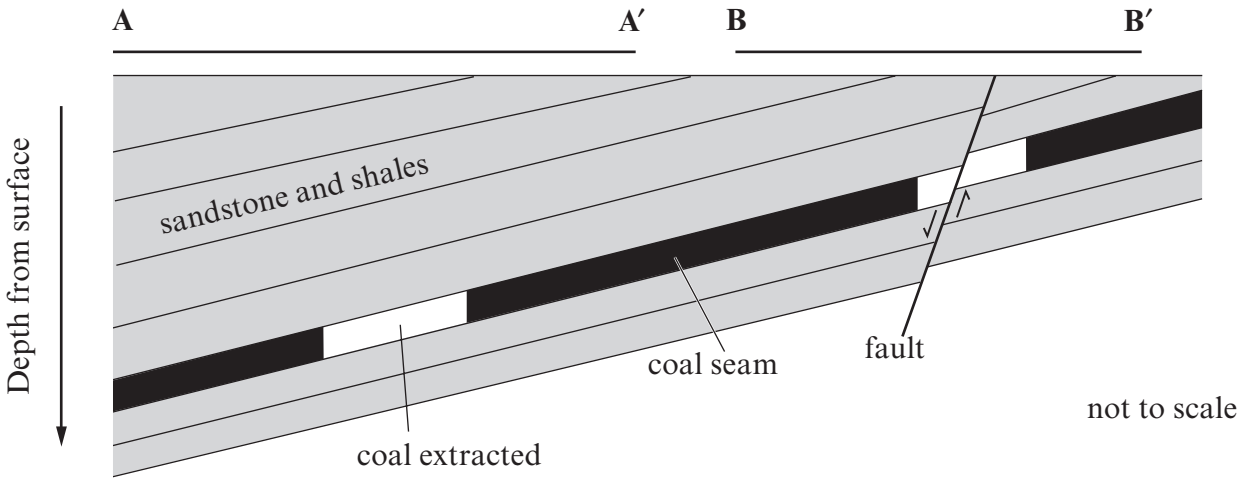

Figure 1b

Source: Adapted from Donnelly and Rees in Quart. Journal of Engineering Geology and Hydrology, (2000) 34

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

(i) Explain why mining can result in subsidence at the surface along transect **A–A′**. [2]

.....

.....

.....

(ii) Calculate the maximum rate of subsidence along transect **A–A′** over the two year period. Show your working. [2]

..... mm yr^{-1}

(b) Compare transect **B–B′** with transect **A–A′**. Describe and explain the difference in the amount of subsidence between the two transects. [3]

Description .....

.....

.....

Explanation .....

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(c) The English Midlands experiences low magnitude (less than 3) earthquakes. Suggest why earthquakes of low magnitude occur in coal mining areas. [2]

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(d) Using your knowledge, explain how mining can lead to surface and/or groundwater pollution. [3]

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2. **Figure 2** shows a cross section of a coastal area where mass movement has occurred. **Table 2a** provides information on the Factor of Safety value that is used to indicate slope stability. **Table 2b** is the calculated Factor of Safety values for future rises in the water table **P** and a deeper water table **Q**.

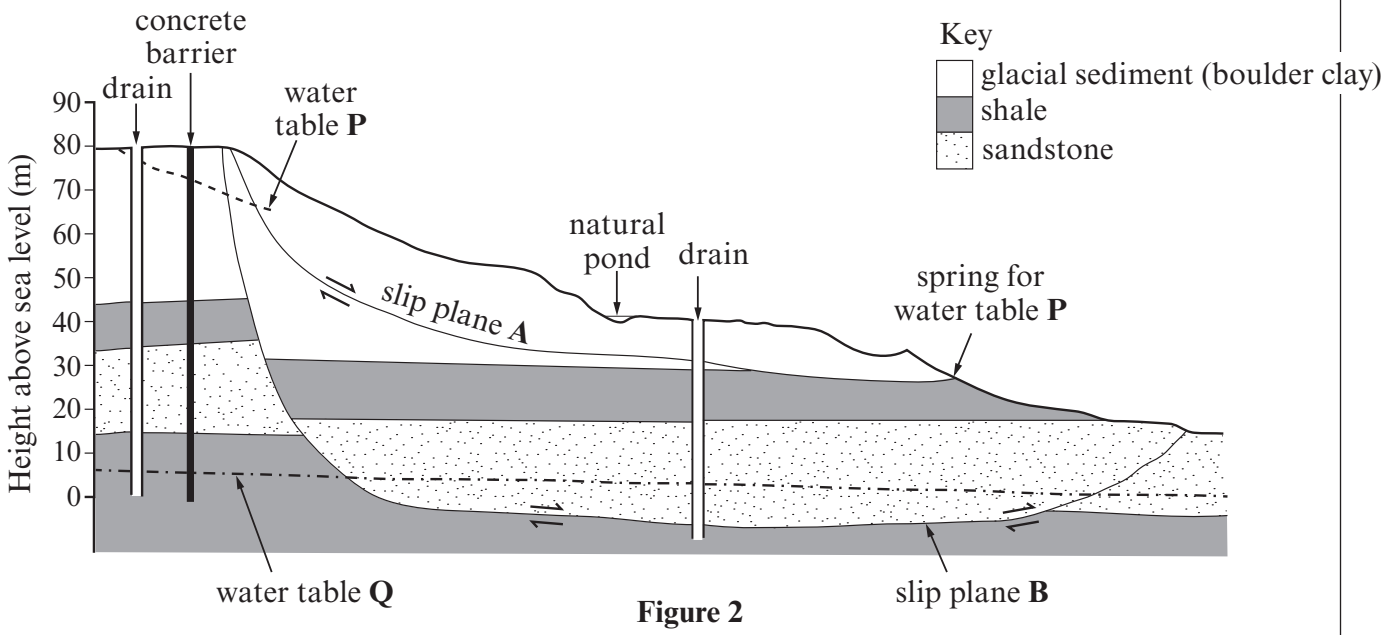

Figure 2

Source: Adapted from http://www.scarborough.gov.uk

Slope stability can be assessed using a Factor of Safety (a value based upon the strength of the material in the slope and the forces acting upon it). A slope is considered to be unsafe if the value is less than 1.

Table 2a

	Water table **P**	Water table **Q**
Current Factor of Safety value	1.035	1.04
Factor of Safety value with **1 m** rise in water table	0.998	1.03
Factor of Safety value with **2 m** rise in water table	0.961	1.01
Factor of Safety value with **3 m** rise in water table	0.927	0.99
Factor of Safety value with **5 m** rise in water table	0.862	

Table 2b: Factor of Safety values for raised groundwater levels

(a) (i) Define what is meant by the term *water table*. [1]

.....

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(ii) Using the evidence from **Figure 2**, complete water table **P** on **Figure 2**. [2]

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(iii) Describe the relationship between a rise in the water table level and the Factor of Safety value. [1]

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(iv) Using **Tables 2a** and **2b**, state the minimum rise in water tables **P** and **Q** for the slope to be considered **unsafe**. [1]

Water table **P** ..... metres Water table **Q** ..... metres

(v) Explain how a rise in water tables could lead to mass movement. [2]

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(b) Explain why the geology of the area will result in greater movement along slip plane **B** than slip plane **A**. [2]

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(c) **Figure 2** shows the location of two methods used to minimise the risk of mass movement.

Describe how drains and a concrete barrier are used to stabilise the slope. [4]

Drains .....

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Concrete barrier .....

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.....

.....

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Turn over.

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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)* Describe, giving reasons, the geological factors that need to be investigated to assess the suitability of a site for the disposal of highly toxic/radioactive waste. [10]

(b) Explain how the problems associated with domestic waste disposal can be controlled by good geological site selection. [15]

OR,

4. *(a)* Describe the properties of aquifers that allow the storage and movement of groundwater. [10]

(b) Explain the geologically related problems that may result from the overuse of aquifers. [15]

OR,

5. *(a)* Describe, with reference to one or more case studies, how the destructive effects of volcanoes may be managed and controlled. [10]

(b) Explain how **two** of the following phenomena may be used to predict a volcanic eruption:

(i) ground deformation;

(ii) gas emissions;

(iii) seismic activity. [15]

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