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 January 2014

1 hour 15 minutes

	For Examiner's use only		
	Question	**Maximum Mark**	**Mark Awarded**
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.

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SECTION A

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

1. **Figure 1a** is a simplified geological section through an aquifer from which hot springs emerge at Bath at temperatures of approximately 45 °C.

Figure 1b is a detailed geological section beneath the King's Bath hot spring.

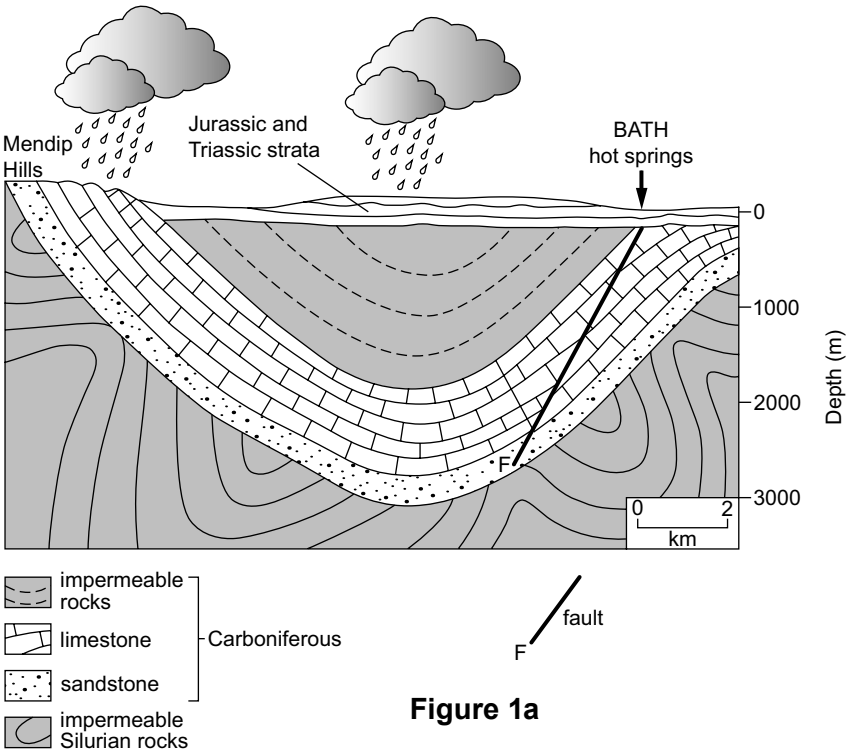

Figure 1a

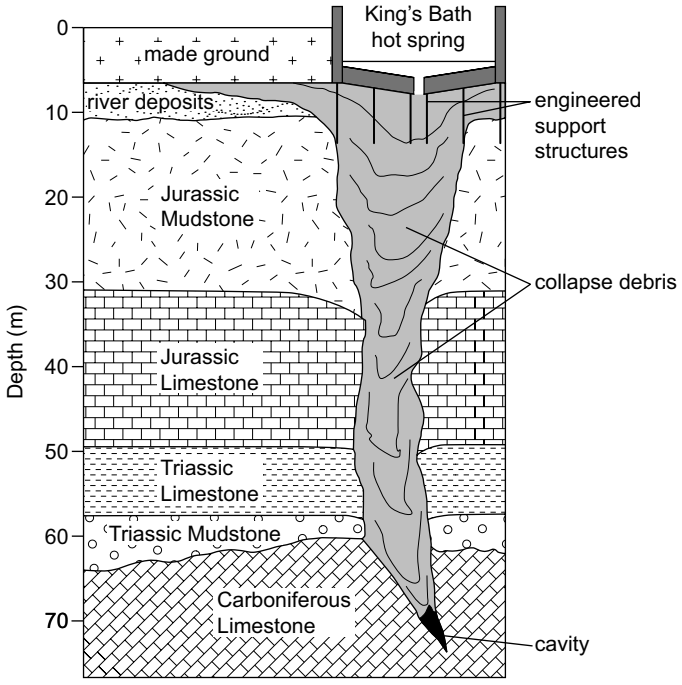

Figure 1b

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Refer to **Figure 1a**.

(a) Clearly label, with an arrow labelled **A** (← **A**) on **Figure 1a**, a location within a major aquifer in rocks which are older than the Triassic. [1]

(b) The average geothermal gradient in this area is 25 °C km^{-1}. Calculate the temperature of rock at a depth of 3000 m. Show your working. [2]

Temperature = ... °C

(c) (i) Using arrows (→ →), show the probable pathway for groundwater flow from the surface which results in hot springs at Bath. [2]

(ii) Explain how the following geological factors have contributed to the hot springs at Bath.

1. Rock type
2. Geological structures (folds, faults and joints) [5]

1. Rock type .....

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2. Geological structures (folds, faults and joints) .....

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Refer to **Figure 1b**.

(d) In 1977 engineering was required at the King's Bath hot spring to overcome natural, localised subsidence. Explain the likely cause of this subsidence. [3]

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Turn over.

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2. **Figure 2a** shows data on ground deformation (tilt) and the type and frequency of earthquakes on Kilauea (Hawaii) prior to a series of eruptions in 1986.

Figure 2b is a partly completed illustration of the types of earthquake associated with eruptions on Kilauea seen in **Figure 2a**.

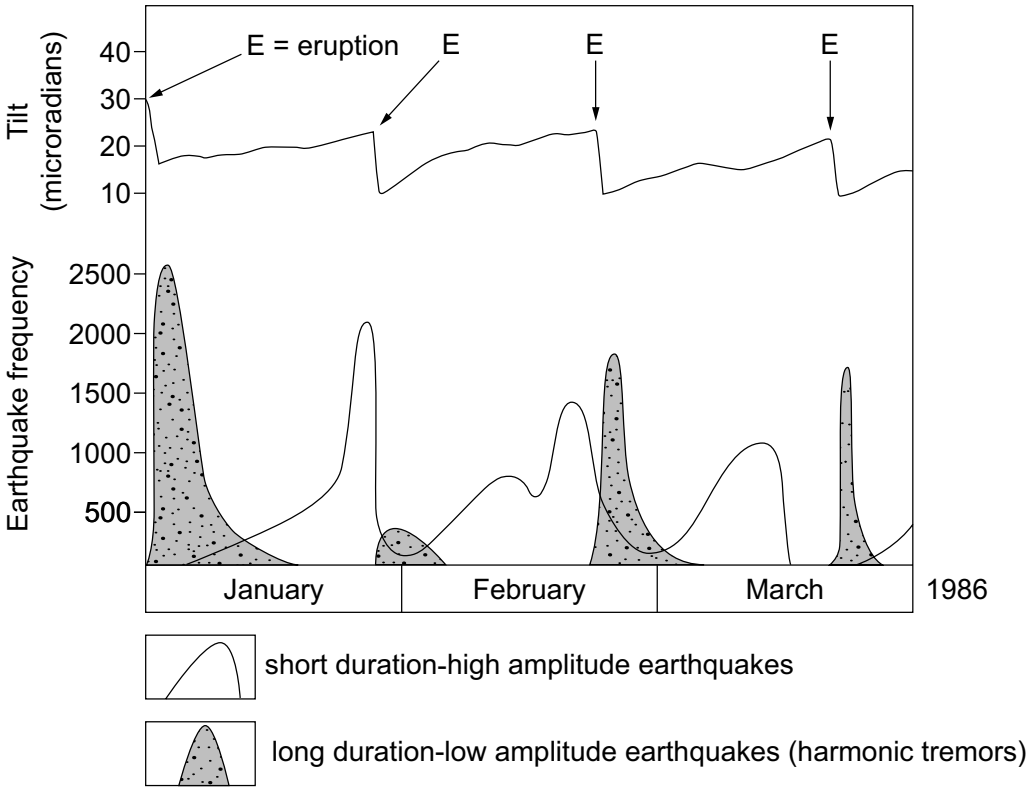


Figure 2a

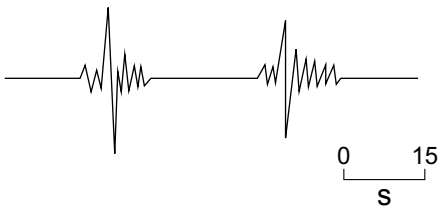
Description	Illustration of earthquake type (drawn to the same scale)	Origin
Short duration-high amplitude earthquake		Associated with the build-up of pressure as volcano inflates (swells) before an eruption
Long duration-low amplitude earthquake (harmonic tremor)		Associated with the release of pressure as volcano deflates (subsides) during an eruption

Figure 2b

Examiner only

Refer to **Figure 2a** and **Figure 2b**.

(a) (i) Describe the changes in ground deformation (tilt) from January to March 1986 in **Figure 2a**. [2]

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(ii) Using the description in **Figure 2b** draw a seismogram to show the characteristic features of an *harmonic tremor*. [2]

(b) (i) Using **Figure 2a**, **describe** how the pattern of earthquake types, when related to changes in ground deformation (tilt), might be used to **predict** an eruption at Kilauea. [2]

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(ii) With reference to **Figure 2a** and **Figure 2b**, **explain** the reasons for the changes in earthquake activity (number and type of seismic events) and ground deformation (tilt) before, during and immediately after a typical eruption from Kilauea. [4]

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(c) From your knowledge, describe **one** *other* monitoring technique that might be used to indicate the movement of magma prior to a volcanic eruption. [2]

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Turn over.

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)* Using annotated diagrams, explain how problems of ground stability may be associated with **two** of the following:

(i) dip of strata;

(ii) orientation of rock cleavage, joint and fault patterns;

(iii) fluctuations in the water table. [15]

(b) Describe the methods that may be used to manage and control unstable slopes. [10]

OR,

4. *(a)* Describe how engineering activity can interfere with the process of longshore drift in coastal areas. [10]

(b) Explain the hazardous effects of such interference with the coastal system. [15]

OR,

5. *(a)* Describe, giving reasons, the geological factors that need to be considered in the disposal of highly toxic and/or radioactive waste compared with the disposal of domestic waste. [15]

(b) With specific reference to one actual (or potential) landfill or underground site, analyse the suitability of the site for the type of waste disposed. [10]

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END OF PAPER

Acknowledgements

Figure 1a
Source: "Groundwater - our hidden asset" (UK Groundwater Forum)

Figure 1b
Source: Gallois, R.W. 2006. The geology of the hot springs at Bath Spa, Somerset. Geoscience in south-west England, 11, 168-173. Proceedings of the Ussher Soc.

Figure 2a
Source: Maguire; GEOLOGY TODAY Sept-Oct 1991