

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.	
<b>Total</b>	<b>50</b>	

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010001

**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.

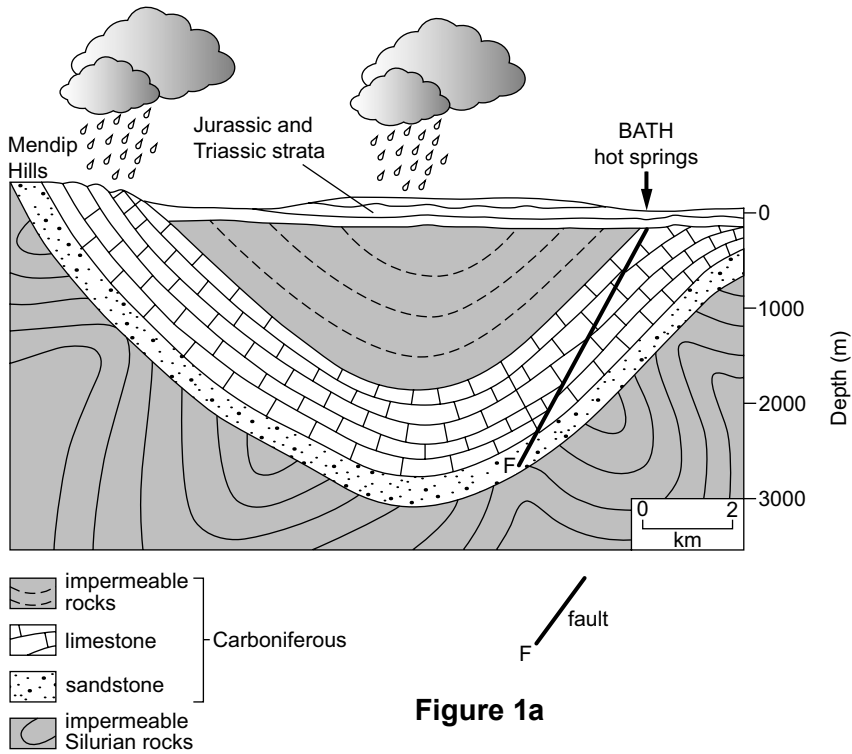
Candidates are reminded that marking will take into account the use of examples and the quality of communication used in answers, especially in the structured essay.

**SECTION A**

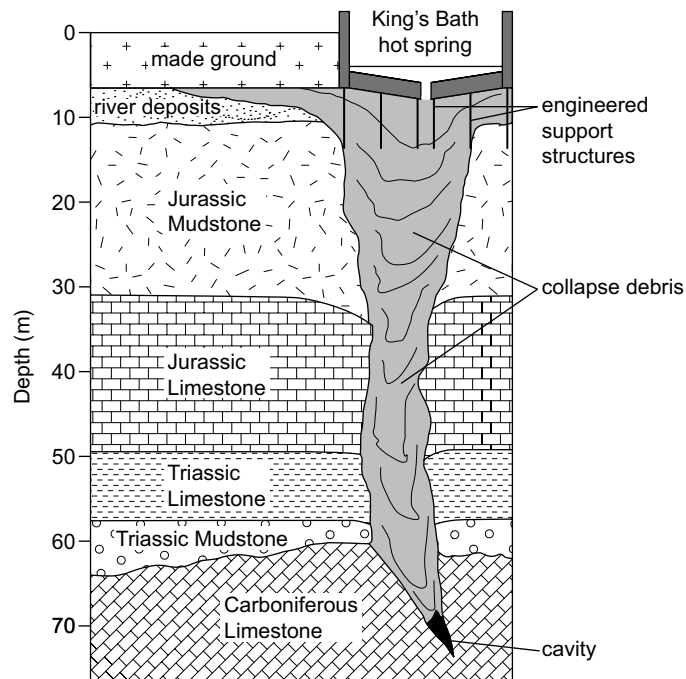
Answer both questions 1 and 2 on the lines provided.

- 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**

Refer to **Figure 1a**.

- (a) Clearly label, with an arrow labelled **A** ( $\leftarrow$  **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  $25\text{ }^{\circ}\text{C km}^{-1}$ . Calculate the temperature of rock at a depth of 3000 m. Show your working. [2]

*Temperature* = .....  $^{\circ}\text{C}$

- (c) (i) Using arrows ( $\rightarrow$   $\rightarrow$ ), 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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.....

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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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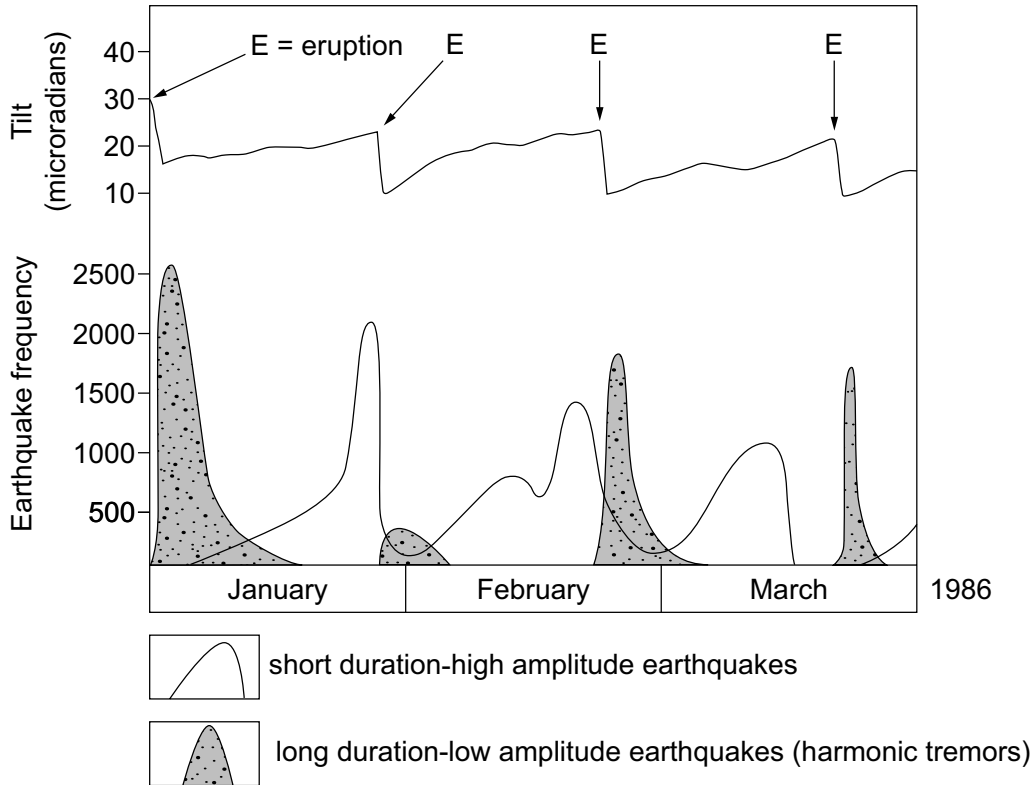
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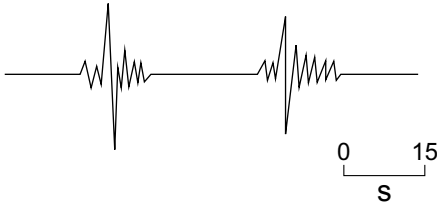

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2. **Figure 2a** shows data on ground deformation (tilt) and the type and frequency of earthquakes on Kilauea (Hawaii) prior to a series of eruptions in 1986.

**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**

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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**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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Examiner  
only

Ruled lines for examiner use.



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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