Candidate Name	Centre Number	Candidate Number
		2

WJEC CBAC

GCE AS/A level

1213/01 **New AS**

GEOLOGY - GL3
GEOLOGY AND THE HUMAN ENVIRONMENT

P.M. WEDNESDAY, 20 May 2009

1¼ hours

For Examiner's Use only.

Section A	**1**	
	2	
Section B	**3**	
	4	
	5	
	Total 50	

ADDITIONAL MATERIALS

In addition to this examination paper, you may require a calculator.

INSTRUCTIONS TO CANDIDATES

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

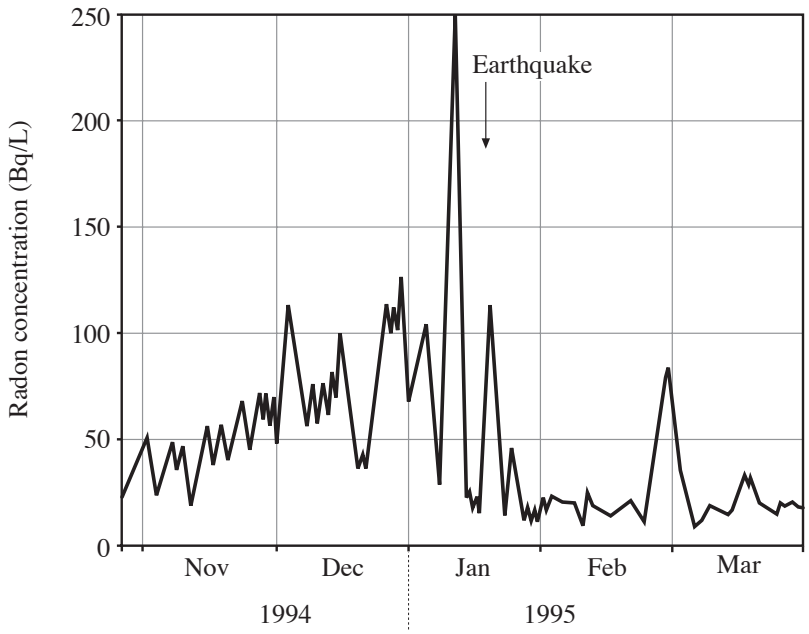
The number of marks is given in brackets at the end of each question or part-question.

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 1** shows the variation in radon gas concentration in groundwater before and after the Kobe earthquake of 17th January 1995, as measured in a well within 30 km of the epicentre.



Source: Adapted from *New Scientist* - 1995

Figure 1

Radon concentration (Bq/L)	**November 1994**	**December 1994**	**January 1995**	**February 1995**	**March 1995**
Maximum	75	135	•	85	75
Minimum	25	43	18	14	5
Range	50	•	232	71	70
Mean	50	82	98	37	28

Table 1

Refer to **Figure 1** and **Table 1**.

(a) Suggest a source of the radon gas in groundwater. [1]

.....

(b) (i) With reference to **Figure 1**, complete the data in **Table 1**. [2]

(ii) Account for the variation in radon gas concentration in the groundwater in **Figure 1** before and after the earthquake. [3]

.....

.....

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.....

(c) (i) Explain how this data might have been used to predict the Kobe earthquake. [2]

.....

.....

.....

(ii) Suggest **two** reasons why it might have been difficult to use this data alone to accurately predict the Kobe earthquake. [2]

Reason .....

.....

Reason .....

.....

(d) From your knowledge, describe **one** other monitoring technique that has been used in earthquake prediction. [2]

.....

.....

.....

Total 12 marks

2. **Figure 2** is a section across the Rhine rift valley at Basle, Switzerland, showing the geological setting of a geothermal project. **Table 2** outlines the development of the project.

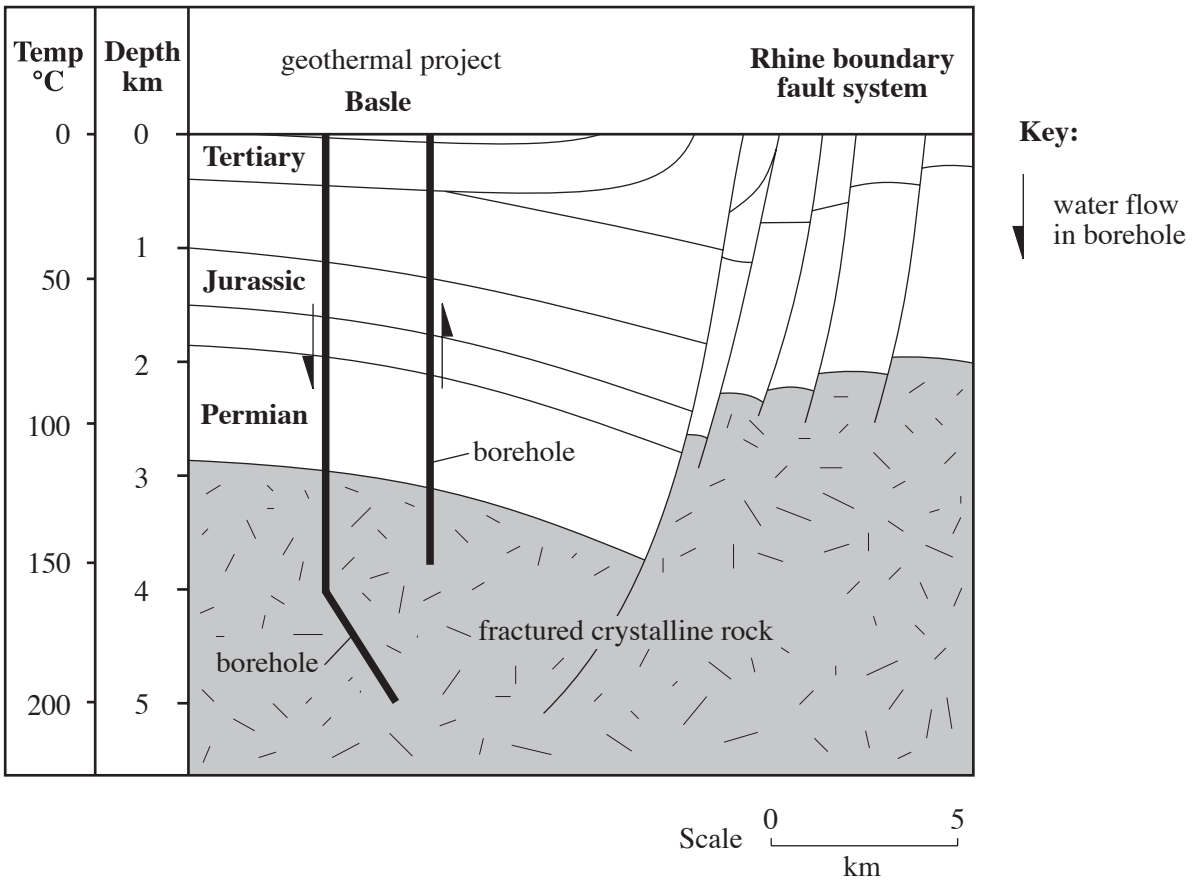

Figure 2

'Green Energy' project gives Swiss the shakes

The Swiss geothermal project, located near Basle, involved injecting water under pressure into 5 km deep boreholes, where rock temperatures can reach 200 °C. The resulting superheated steam is brought back to the surface where it is used to run a turbine and generate electricity. In 2007, pumping was shown to trigger minor earthquakes of 3.3 on the Richter scale as far away as 15 kilometres. The project is currently suspended.

Adapted from Sunday Telegraph (19/02/2007)

Table 2

(a) Using evidence from **Figure 2** and **Table 2**,

(i) calculate the geothermal gradient (the change in temperature with depth) down the borehole (Show your working), [2]

..... °C km^{-1}

(ii) suggest **two** reasons why the crystalline rock was suitable for the development of this geothermal project. [2]

Reason .....

Reason .....

(b) (i) Estimate the likely level of damage caused by a 3.3 earthquake on built structures in a modern European city like Basle. [2]

.....

.....

(ii) State **two** factors that may have affected the **intensity** (as measured on the modified Mercalli scale) of the 3.3 earthquakes in Basle. [2]

Factor .....

Factor .....

(c) Explain how injecting water under pressure may have triggered the minor earthquake events. [3]

.....

.....

.....

.....

(d) Using your knowledge, explain why the risk from earthquakes is usually greater in cities (such as Basle) than in rural areas. [2]

.....

.....

.....

Total 13 marks

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 **one** or more **named** volcanic eruptions you have studied and provide details of **two** volcanic hazards associated with the event(s). [15]

(b) Explain the extent to which these hazards were dependent upon the characteristics of the magma involved (e.g., composition, viscosity or gas content). [10]

OR,

4. *(a)* Describe how mass movement of rock and water may result from volcanic activity and earthquake events. [15]

(b) Explain how sites of potential slope failure in volcanic or seismic areas can be monitored. [10]

OR,

5. *(a)* Using case studies where possible, explain why engineering activities need to take account of geological factors to avoid unintentional interference with the natural environment. [15]

(b) Describe how one or more geological hazards, associated with engineering activity, has been managed in order to reduce the risk of loss of life or property damage. [10]

Examiner only

Turn over.

Examiner only

Examiner only

Turn over.

Examiner only