Candidate Name	Centre Number	Candidate Number
		2

General Certificate of Education
Advanced Subsidiary/Advanced

453/01

GEOLOGY – GL3
GEOLOGY AND THE HUMAN ENVIRONMENT

P.M. THURSDAY, 10 January 2008
(1 hour 15 minutes)

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 answer 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.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

SECTION A

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

1. **Figure 1** shows the relative change in some physical indicators recorded before, during and after a major earthquake event, which might be used in earthquake prediction.

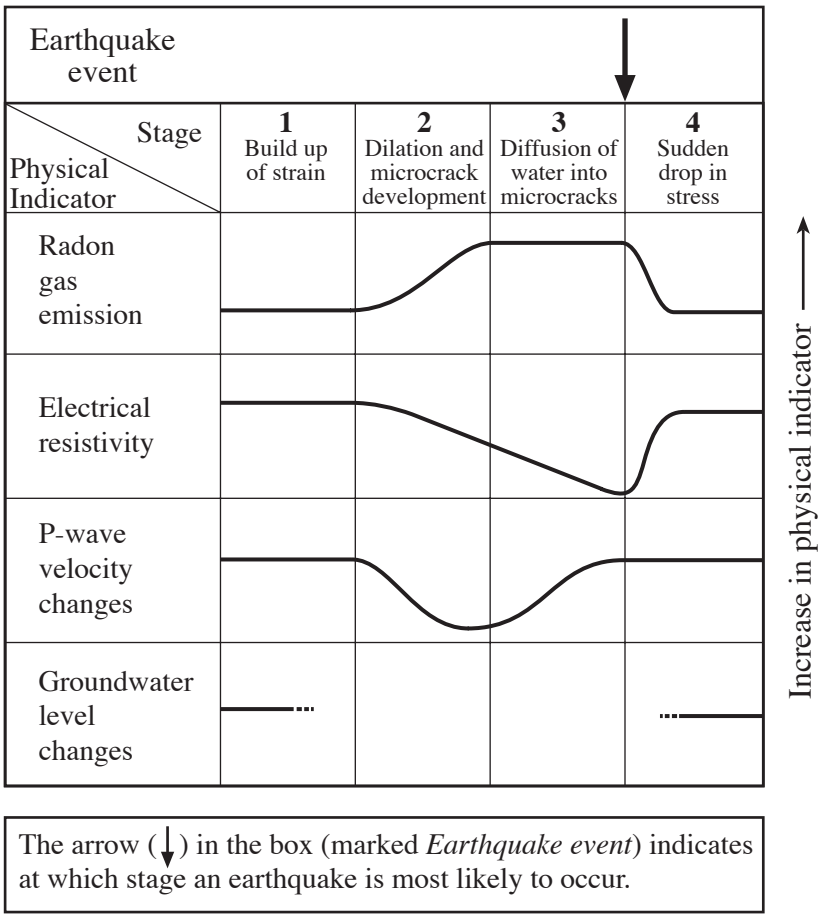

Figure 1

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

(i) Complete the graph to show how groundwater levels, recorded in wells, might change during stages **1** to **4**. [2]

(ii) Account for the changes in **one** of the indicators recorded in **Figure 1**. [4]

Chosen indicator .....

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(b) **Table 1** gives percentage changes (from normal background values) of three indicators at a monitoring station in an active fault zone. The data are shown at weekly intervals. An earthquake warning was issued in **Week 5**.

Indicator	Week 1	Week 2	Week 3	Week 4	Week 5
Radon gas emission	0	+5	+8	+12	+12
Electrical resistivity	0	-1	-3	-4	-7
P-wave velocity	0	-1	-2	-5	-3

Table 1

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

(i) Using **Figure 1**, explain how the data in **Table 1** support the decision to issue a warning in **Week 5**. [2]

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(ii) Explain why such a warning might not be effective. [3]

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(c) Explain **one** way in which the risk of damage in active fault zones might be managed or controlled. [2]

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Total 13 marks

2. **Figure 2** is a geological map of the area around the Clubbiedean and Torduff reservoirs near Edinburgh. **Table 2** gives the background to the subsidence and leakage of the Clubbiedean Reservoir.

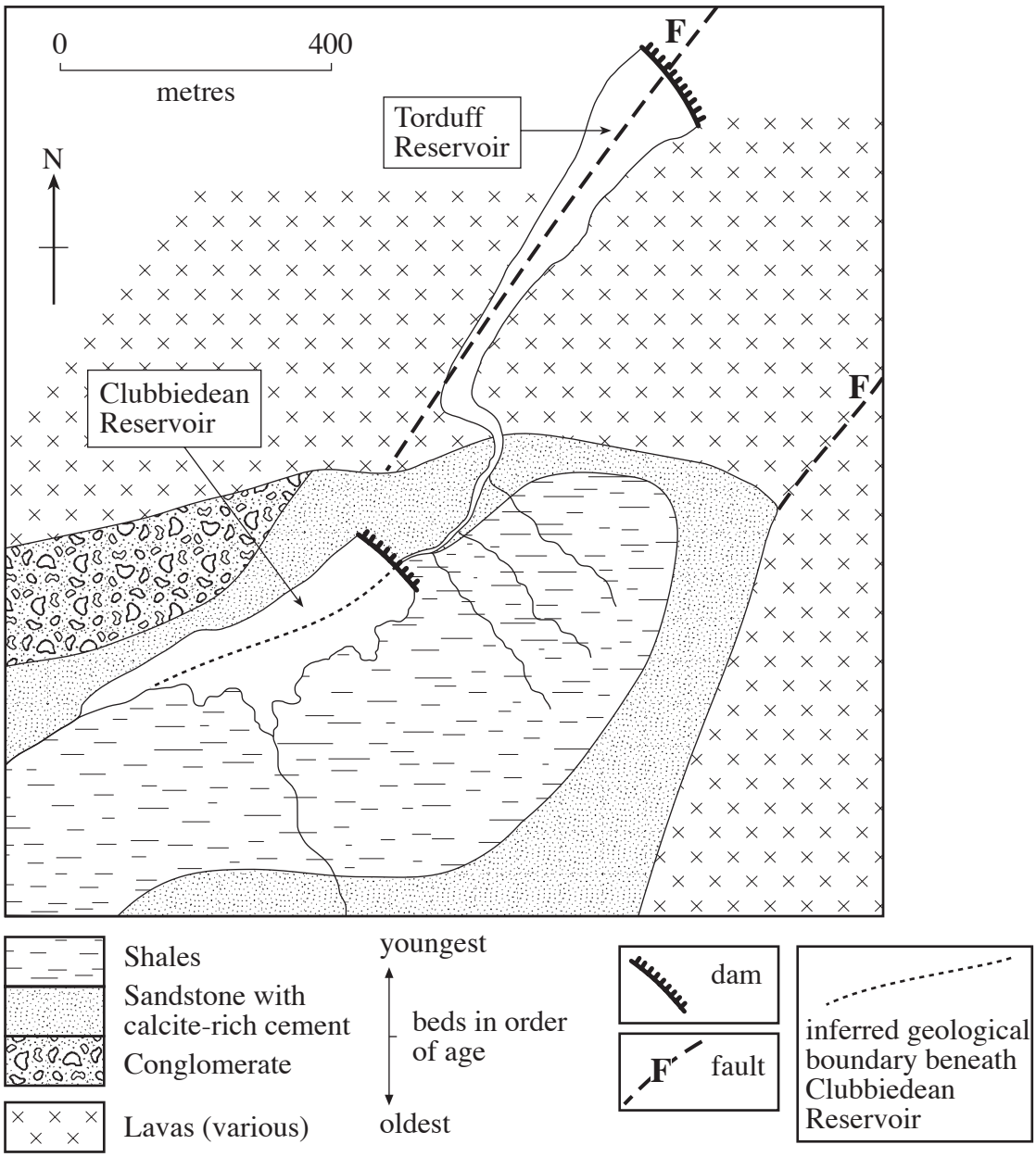

Figure 2

Subsidence and leakage at Clubbiedean Reservoir

Built in 1850, the Clubbiedean Reservoir and dam are situated on the northern flank of a shallow fold. Leakage had persisted over a long period, with water visibly flowing into the ***calcite-rich sandstone*** *beneath the reservoir through cracks associated with depressions, indicating local subsidence. A zone of cavities, formed after the dam was built and extending down to about 10m below the rockhead, was found to be responsible.*

Adapted from: *Geology for Civil Engineers – McLean & Gribble 1979: Allen & Unwin*

Table 2

Refer to **Figure 2** and **Table 2** as appropriate.

(a) State **one** possible advantage and **one** possible disadvantage of the geology of the **Torduff** Reservoir site for water storage.
Explain your answers. [4]

Advantage .....

Explanation .....

.....

.....

Disadvantage .....

Explanation .....

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(b) (i) Mark and label the axial plane trace of the *shallow fold* on **Figure 2**. [1]

(ii) Name this type of fold. Explain the evidence from **Figure 2** for your answer. [2]

Fold type .....

Evidence .....

(iii) Explain why this type of fold might have been an advantage in the site selection for the **Clubbiedean** Reservoir. [2]

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(c) With reference to **Figure 2**, explain how the cavities may have formed within the sandstone beneath the **Clubbiedean** Reservoir **(Table 2)**. [3]

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Total 12 marks

SECTION B

Answer one question from this section on the following pages.

You are advised to make use of examples where possible in your answer.

EITHER,

3. *(a)* Describe the factors that affect the risk of damage to property or loss of life in areas of natural hazards. [10]

(b) Explain how **two** of the following might be used to minimise the risk from the destructive effects of natural hazards:

(i) control of lava speed and direction;
(ii) controlled stress release along faults;
(iii) slope stabilisation methods. [15]

OR,

4. *(a)* Describe the factors that influence the intensity of earthquake damage in the area around an epicentre. [10]

(b) Describe and account for the hazardous effects of one or more major earthquakes on built structures. [15]

OR,

5. *(a)* Describe the different types of rock discontinuities likely to be encountered during the site investigation for a major engineering project. [10]

(b) Using examples where possible, explain how the orientation of rock discontinuities and rock strength can affect ground stability during the excavation of cuttings or tunnels. [15]

Examiner only

Turn over.

Examiner only

Examiner only