| Candidate Name | Centre Number | Candidate Number |
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| | | 0 |

GCE AS/A level

453/01

# GEOLOGY - GL3
# GEOLOGY AND THE HUMAN ENVIRONMENT

P.M. WEDNESDAY, 21 May 2008

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.

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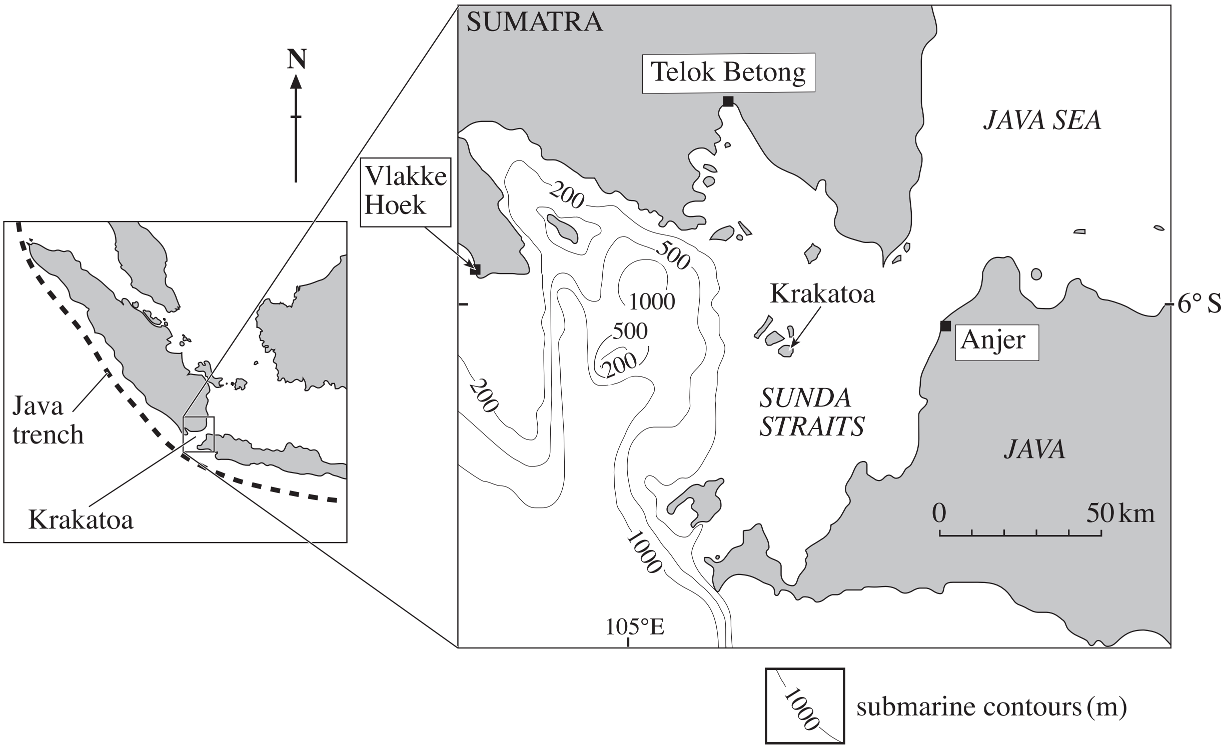
## SECTION A

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

**1.** **Figure 1** shows the tectonic setting of the volcanic island of Krakatoa (Indonesia) that erupted violently in 1883, generating tsunamis causing more than 36,000 deaths. **Table 1** shows data on the tsunami generated at the climax of the eruption.




*Source: http://www.drgeorgepc.com/Tsunami1883Krakatau.html*

**Figure 1**

| Coastal town | Distance from Krakatoa (km) | Tsunami arrival time after eruption climax (min) | Mean velocity of tsunami wave (**km hr$^{-1}$**) | Max tsunami height (m) |
|---|---|---|---|---|
| Vlakke Hoek | 96 | 40 | 144 | 15 |
| Anjer | • | 40 | • | 15 |
| Telok Betong | 80 | 60 | 80 | 22 |

**Note:** ***The height and velocity of a tsunami depends upon many factors including the shape of the shoreline and depth of the water across which it travels.***

**Table 1**

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

*(a)* (i) Name the type of magma likely to account for the explosive eruption of Krakatoa in 1883. [1]

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(ii) Explain why magma of this type is typical of this region. [2]

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*(b)* The height and velocity of a tsunami depend upon many factors including the shape of the shoreline and depth of the water across which it travels.

(i) Use **Figure 1** to complete **Table 1** by

1. recording the distance from Krakatoa to Anjer,
2. calculating the mean velocity of the tsunami crossing the Sunda Straits to Anjer (in **kilometres per hour**). Show your working below. [3]

(ii) Describe and explain the **difference** in arrival times of tsunamis at Vlakke Hoek and Telok Betong following the eruption climax. [3]

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(iii) Suggest **two** possible reasons why the maximum height of the tsunami at Telok Betong was higher than at the two other coastal towns. [2]

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*(c)* Using your knowledge, explain the use of **one** method to reduce the risk from the destructive effects of tsunamis. [2]

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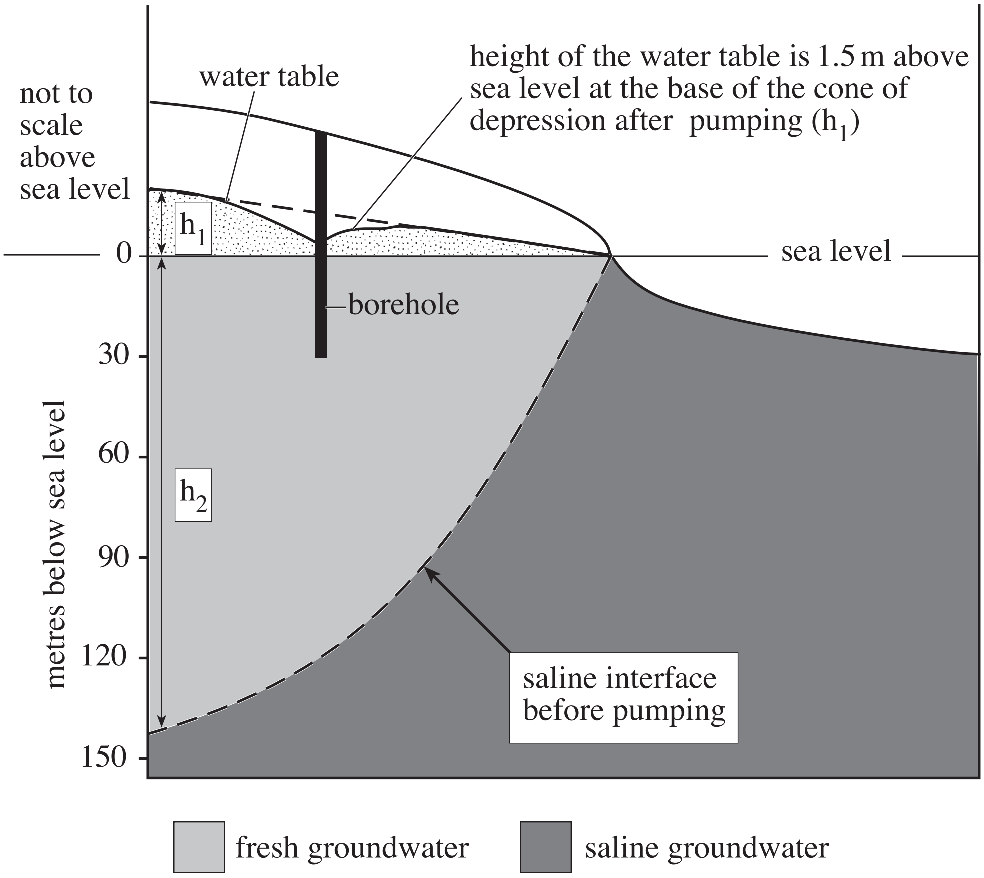
**Total 13 marks**

**2.** **Figure 2a** shows the relationship between fresh and saline groundwater (saltwater) in a coastal aquifer.




The depth to the saline interface (the boundary between fresh and saline groundwater) (**$h_2$**) is approximately 40 times the height of the water table (**$h_1$**) above sea level.
Thus (**$h_2 = 40 \times h_1$**)

**Figure 2a**

Refer to **Figure 2a**

*(a)* Give a reason why saline groundwater is found below fresh water in coastal aquifers. [1]

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*(b)* (i) Explain why a cone of depression has developed in the water table around the borehole. [2]

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(ii) Complete **Table 2** below by calculating the depth to the saline interface below the borehole ($\mathbf{h_2}$) after pumping. You should make use of the formula in **Figure 2a**. [1]

| | height of the water table above sea level ($\mathbf{h_1}$) at borehole site (m) | depth to saline interface ($\mathbf{h_2}$) ($\mathbf{h_2 = 40 \times h_1}$) (m) |
|---|---|---|
| before pumping | **3** | **120** |
| after pumping | 1.5 | • |

**Table 2**

(iii) Sketch on **Figure 2a**, the probable local change in the depth of the saline water interface ($\mathbf{h_2}$) associated with this cone of depression. [2]

*(c)* **Figure 2b** is a section through the Chalk (a form of limestone) aquifer, near Brighton.

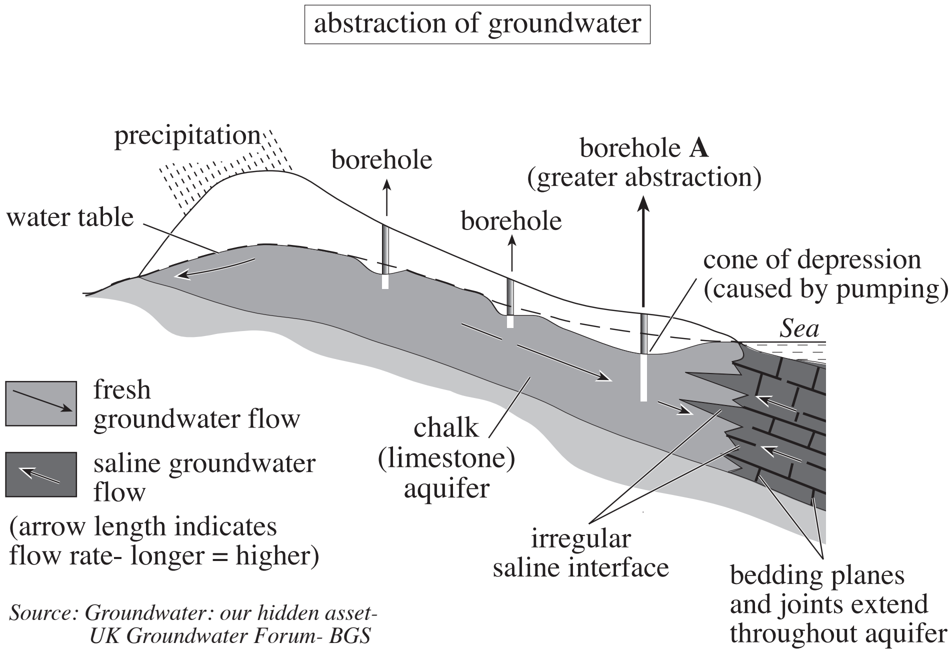


**Figure 2b**

Refer to **Figure 2b**.

**Figure 2b** shows the pattern of groundwater abstraction from the aquifer.

(i) State **two** properties of sedimentary rock that may allow groundwater to flow within the Chalk. [2]

1. ..........

2. ..........

(ii) Explain how the overpumping of borehole **A** might result in problems with the water supply abstracted from the aquifer. [2]

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**Turn over.**

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*(d)* Using your knowledge, explain how the stability of the ground around an abstraction borehole can be affected by overuse of the aquifer. [2]

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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 how the mechanisms and triggers of mass movement (e.g. rock avalanches, landslides and debris flows) are linked to natural processes and rock properties. [15]

*(b)* Explain how slopes prone to mass movements might be stabilised. [10]

**OR,**

**4.** *(a)* Describe the factors you would investigate to assess the suitability of a potential landfill site for the disposal of domestic waste. [15]

*(b)* Explain why former landfill sites may pose problems for future development of the area. [10]

**OR,**

**5.** *(a)* Using one or more case studies, describe the effects of volcanic hazards that might result from **two** of the following:

(i) volcanic ash;
(ii) volcanic gases;
(iii) volcanic mudflows (lahars). [15]

*(b)* Explain how the movement of underground magma may result in indicators that can be used in the prediction of volcanic eruptions. [10]

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