| Surname | Centre Number | Candidate Number |
|---|---|---|
| First name(s) | | 2 |

# GCE A LEVEL

A480U10-1

S25-A480U10-1

**TUESDAY, 3 JUNE 2025 – MORNING**

## GEOLOGY – A level component 1
### Geological Investigations

2 hours 15 minutes

**ADDITIONAL MATERIALS**
- the Resource Sheet
- the Mineral Data Sheet
- the Photographs of Specimens
- **specimens C**, **D**, **F** and **G**
- geological equipment for testing specimens
- a strip of plain paper
- a calculator
- a ruler
- a protractor

**INSTRUCTIONS TO CANDIDATES**
Answer **all** questions.
Use black ink or black ball-point pen. Do not use gel pen or correction fluid.
You may use a pencil for graphs and diagrams only.
Write your name, centre number and candidate number in the spaces at the top of this page.
Write your answers in the spaces provided in this booklet. If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

**INFORMATION FOR CANDIDATES**
This paper is in 2 sections, **A** and **B**.
Section **A**: 30 marks. Answer **both** questions. You are advised to spend about 35 minutes on this section.
Section **B**: 75 marks. Answer **all** questions. You are advised to spend about 1 hour 40 minutes on this section.
The geology is **not** designed to represent any particular area.
The Mineral Data Sheet and **Map 1** are provided on separate resource sheets.
Four specimens, **C**, **D**, **F** and **G**, are provided for use.
The number of marks is given in brackets at the end of each question or part-question.
The assessment of the quality of extended response (QER) will take place in questions **2** and **6**.

| | For Examiner's use only | | |
|---|---|---|---|
| | **Question** | **Maximum Mark** | **Mark Awarded** |
| **Section A** | **1.** | **17** | |
| | **2.** | **13** | |
| **Section B** | **3.** | **9** | |
| | **4.** | **5** | |
| | **5.** | **6** | |
| | **6.** | **9** | |
| | **7.** | **7** | |
| | **8.** | **8** | |
| | **9.** | **3** | |
| | **10.** | **14** | |
| | **11.** | **14** | |
| | **Total** | **105** | |

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## Section A

Answer **all** questions.

**1.** **Figure 1a** is a graph showing the relationship between the temperature and time after burial of a source rock required for oil and gas to form.

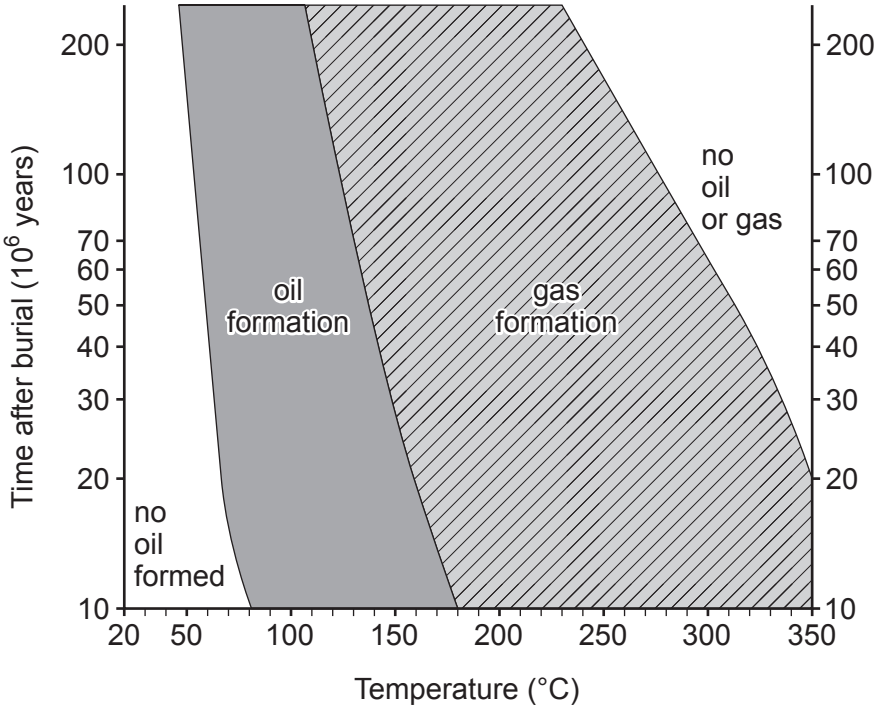



**Figure 1a**

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

(i) State the minimum temperature which must be reached for gas formation to begin in a source rock buried for 200 million years. [1]

.....

(ii) State the time after burial when oil formation will begin, if a source rock has been heated to 60°C. [1]

.....

(iii) Explain how oil is converted to gas at higher temperatures. [1]

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(b) **Figure 1b** is a cross-section through the Ekofisk oil field in the North Sea.

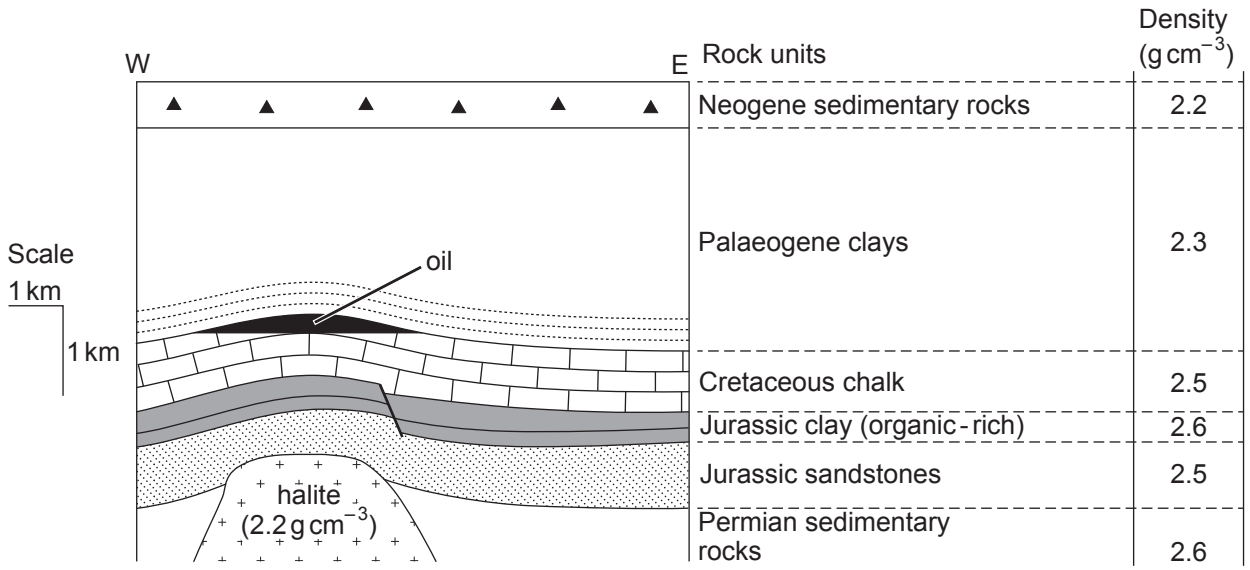



**Figure 1b**

(i) Complete **Table 1** by stating the **rock units** that act as the source, reservoir and cap rock in the Ekofisk oil field. [3]

| Feature of the oil field | Rock unit |
|---|---|
| source rock | • |
| reservoir rock | • |
| cap rock | • |

**Table 1**

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(ii) State the environment and climatic conditions required for the deposition of chalk. [2]

Environment .....

.....

Climatic conditions .....

.....

(iii) Account for the shape of the halite deposit within the Ekofisk oil field shown in **Figure 1b**. [2]

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(c) **Figure 1c** shows the results of a geophysical survey to locate hydrocarbon deposits in the North Sea.

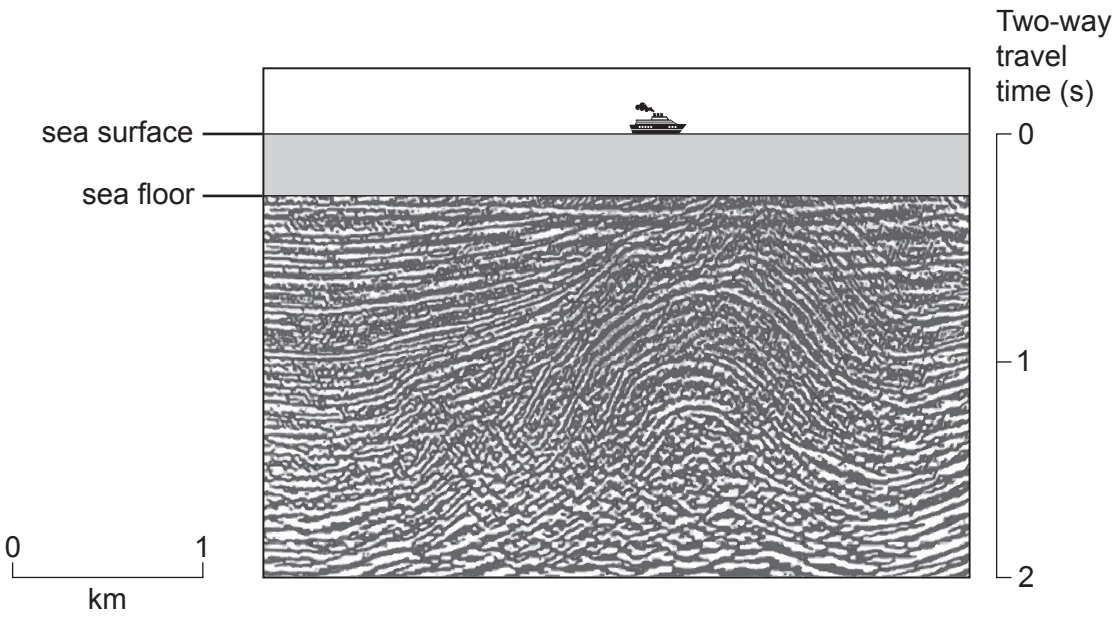



**Figure 1c**



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(i) Name the type of geophysical survey used to collect the data shown in **Figure 1c**. [1]

.....

(ii) State the name of **one** type of hydrocarbon trap shown in **Figure 1c**.

Draw a vertical line on **Figure 1c** to indicate the best location for a vertical borehole to be drilled to establish whether hydrocarbons are present in this hydrocarbon trap.

Explain your choice of location. [3]

Type of trap .....

Explanation .....

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(d) Describe how geologists use microfossils when prospecting for oil and gas. [3]

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**2.** **Figure 2a** shows a drawing of a fossil sketched by the geologist William Smith.

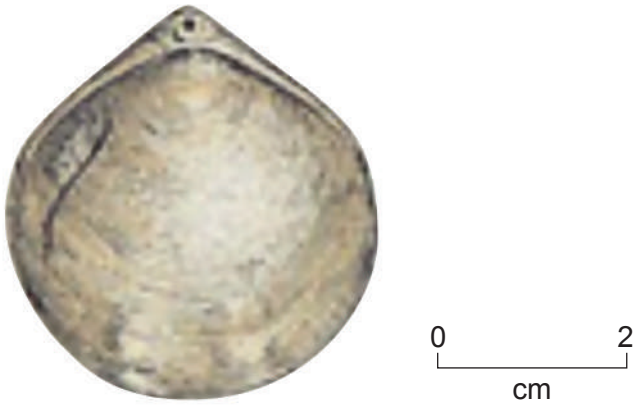



**Figure 2a**

(a) State the fossil group shown in **Figure 2a**. Give **one** reason for your answer. [2]

Fossil group .....

Reason .....

.....

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(b) **Figure 2b** shows a rock outcrop in Scotland, used by the geologist James Hutton to develop the principle of uniformitarianism.

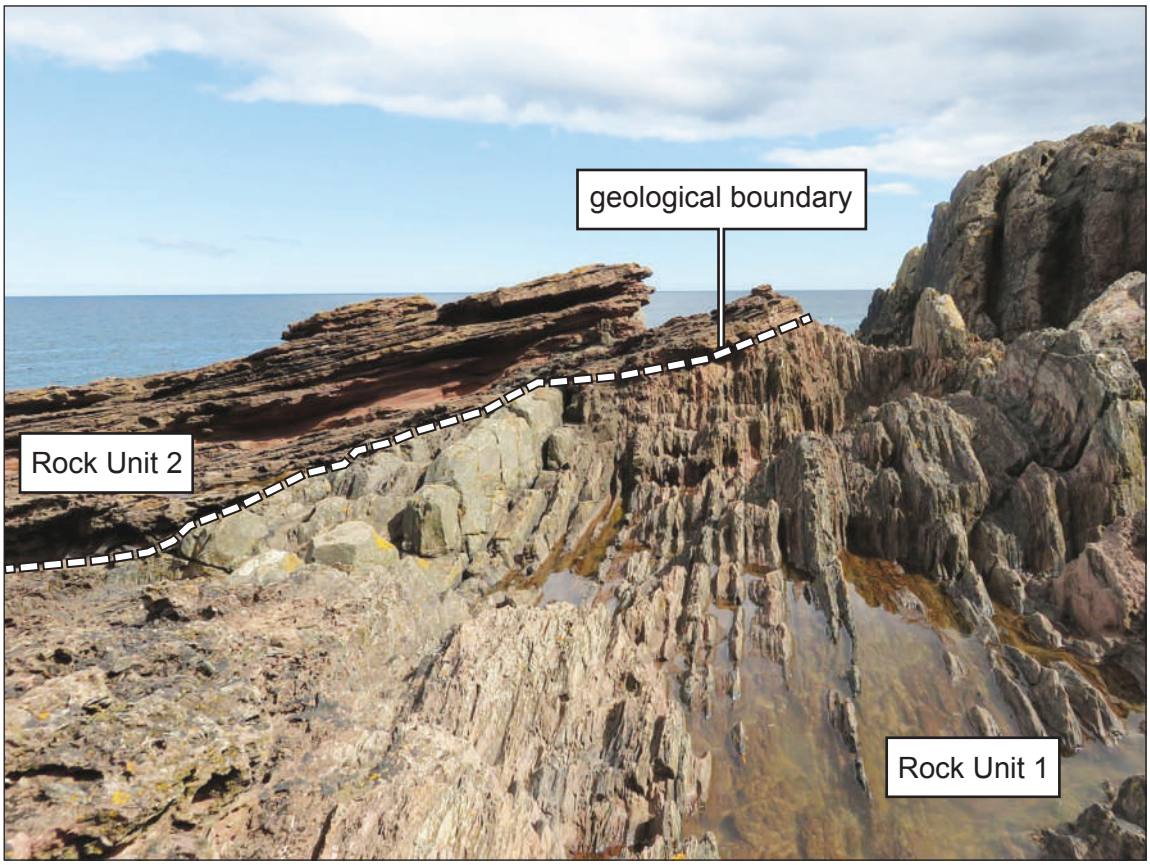



**Figure 2b**

(i) Measure the apparent dip angle of the bedding planes in Rock Unit 2. [1]

.....°

(ii) Describe how the true dip angle and direction of the bedding planes in Rock Unit 2 could be measured by a geologist visiting the site shown in **Figure 2b**. You may wish to use an annotated diagram(s) in your answer. [4]

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(c) Describe:

- the rock cycle processes that have formed the geological features that can be seen in **Figure 2b**
- how the principle of uniformitarianism enabled James Hutton to demonstrate at this outcrop that geological processes take place over millions of years.

You may wish to use an annotated diagram(s) as part of your answer. [6 QER]

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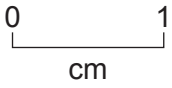
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## Section B

Answer **all** questions.

**3.** **Specimen D** is a cast of a fossil collected from **Rock Unit D** on **Map 1**.

(a) Draw a diagram of **Specimen D** using the scale provided. [5]








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**Turn over.**

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(b) **Figure 3** is a fossil identification key.

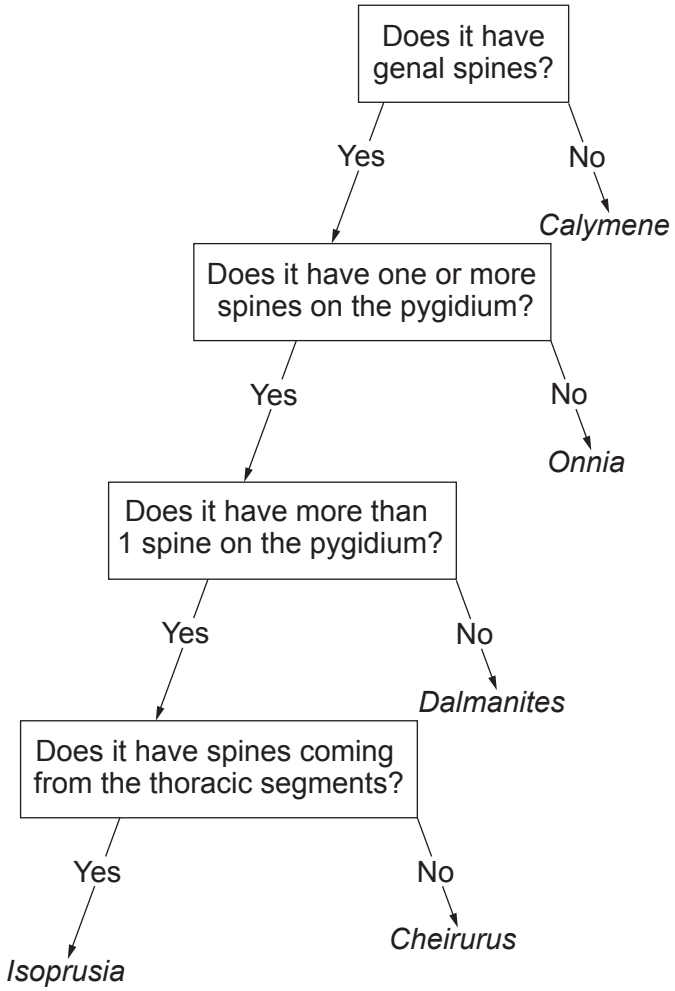



**Figure 3**

State the name of **Specimen D** using **Figure 3**. [1]

**Specimen D** .....

(c) Suggest the probable mode of life of **Specimen D**. Give **two** reasons for your answer. [3]

Mode of life .....

Reason 1 .....

.....

Reason 2 .....

.....

9



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**4.** A student investigated a fossil species found at **Locality 1** and **Locality 2** in **Rock Unit D** on **Map 1. Table 2** shows the number of fossils, the maximum length of each fossil and the percentage of unbroken fossils at the two localities.

| | **Locality 1** | **Locality 2** |
|---|---|---|
| Total number of fossils | 22 | 12 |
| Maximum length of each fossil (mm) | 24, 34, 37, 38, 31, 29, 32, 34, 28, 33, 41, 38, 32, 34, 30, 29, 31, 38, 29, 35, 34, 28 | 27, 47, 22, 34, 51, 21, 44, 25, 21, 39, 32, 19 |
| Percentage of unbroken fossils (%) | 78 | 45 |

**Table 2**

(a) Refer to **Table 2**. The student intended to test the null hypothesis that

"there is no significant difference between the maximum length of the fossils at the two localities."

Suggest the most suitable statistical test to use by ticking **one** of the boxes below. Give a reason for your answer. Tick (✓) only **one** box. [2]

Spearman's Rank ☐

Chi-squared ☐

Mann-Whitney U test ☐

Reason .....

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(b) The student concluded that the fossils at **Locality 1** are more likely to be a death assemblage than the fossils at **Locality 2**. Evaluate this statement. [3]

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**5.** **Specimen C** was collected from **Rock Unit C** at **Locality 3** on **Map 1**.

(a) State the name of the rock forming **Specimen C**. Give **two** reasons for your answer. [3]

Rock name .....

Reason 1 .....

.....

Reason 2 .....

.....

(b) **Rock Unit C** forms an igneous body. A student concluded that it is a lava flow. Evaluate this statement using evidence from **Specimen C** and **Map 1**. [3]

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**6.** Plan a field investigation to collect evidence from the area within **Box M** on **Map 1**. Your investigation must enable the relative age relationships between **Rock Unit C** and **Rock Unit A** to be determined.

For each piece of evidence state:

- what you would observe/measure
- how you would collect the data
- why you are collecting the data.

You may wish to use an annotated diagram(s). [9 QER]



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**7.** **Specimen G** was collected at **Locality 4** on **Map 1**.

(a) (i) Refer to the Mineral Data Sheet. Complete **Table 3** by:

- stating the result of the described lustre observation
- describing **one** other diagnostic test/observation, and stating the result, to confirm the identity of the mineral forming **Specimen G**. [3]

| Description of test/observation | Results of test/observation |
|---|---|
| scratch with a fingernail and copper coin | not scratched by fingernail but is scratched by copper coin |
| observe the reaction with dilute HCl | no reaction |
| observe the lustre (the appearance of the surface in reflected light) | • |
| • | • |

**Table 3**

(ii) Name the mineral forming **Specimen G**. [1]

Mineral .....

(b) Explain why **Specimen G** was formed at **Locality 4**. [3]

.....

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7



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**8.** **Specimen F** was collected from **Rock Unit F** on **Map 1**.

(a) (i) Describe the texture of **Specimen F**. [3]

.....

.....

.....

.....

(ii) Name **one** rock-forming mineral found in **Specimen F**. [1]

.....

(b) **Specimen F** is a metamorphic rock. A student concluded that it was formed as a result of:

- regional metamorphism
- of limestone
- at a high grade
- following burial to a maximum depth of 100 m.

Evaluate the student's conclusion, giving reasons for your answer. [4]

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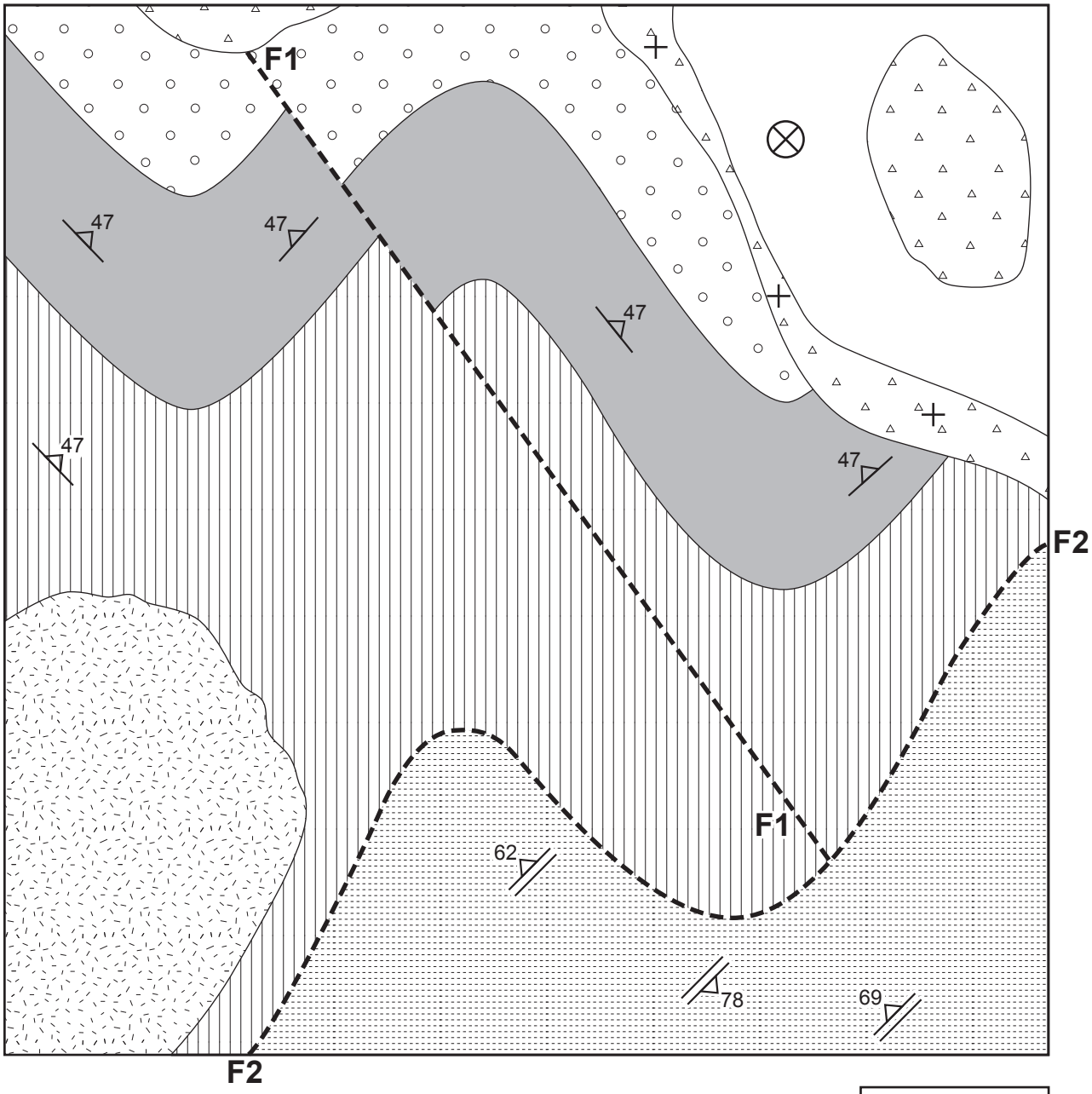


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**9.** **Map 2** shows the area of **Map 1**. The key for the rock units is the same as for **Map 1**.

On **Map 2** clearly mark and label the position of **three** synformal fold axial plane traces using the symbol in the key. [3]




**Map 2**

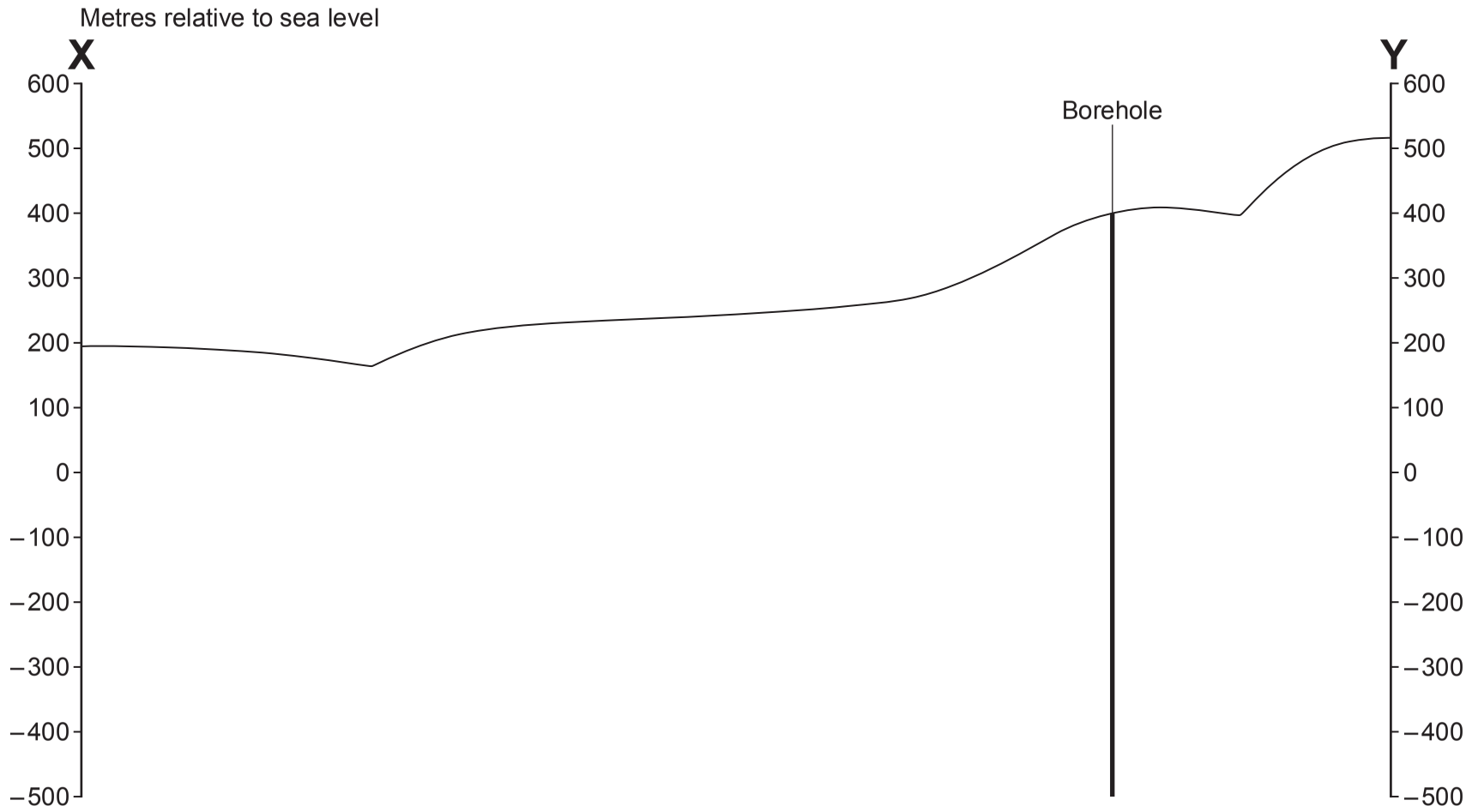
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**10.** The topographic profile below was taken along the line **X–Y** on **Map 1**.
Construct the geological cross-section along this line using **Map 1** and the **borehole data** on the Resource Sheet.

- Draw the rock units. Use similar ornament, or letters, for those on **Map 1**.
- Draw and label any **fold axes**, with the correct symbol.
- Draw any **faults**.
- **Project** the rock units and structures **above** the ground surface to illustrate any cross-cutting relationships. [14]




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**11.** A core sample was obtained from **Rock Unit A** on **Map 1**. The sample was tested by compressing the ends of the core and measuring the strain. The results are shown in **Figure 11a**.

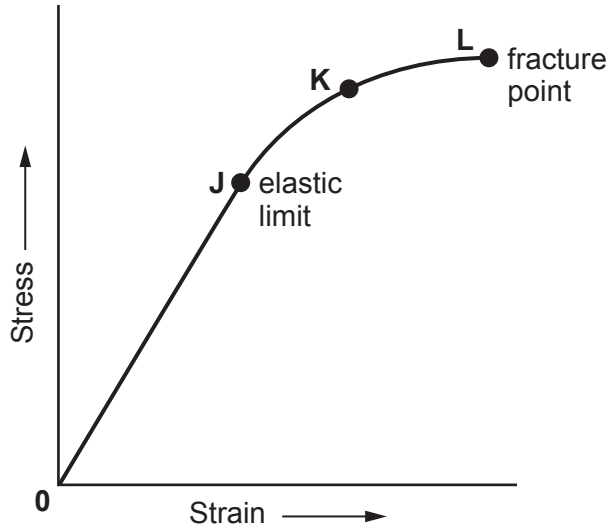



**Figure 11a**

(a) Describe the relationship between stress and strain shown in **Figure 11a**. [2]

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.....

.....

(b) State the type of strain between the following points on **Figure 11a**: [2]

**0** and **J** .....

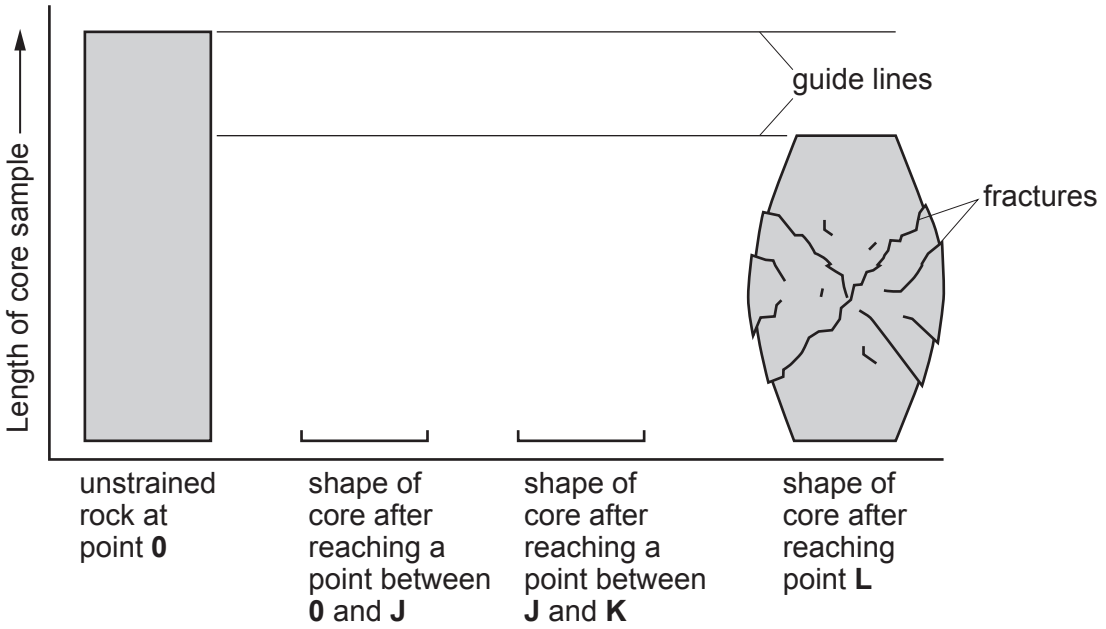
**J** and **L** .....



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(c) Complete **Figure 11b** below by sketching **two** cores to show the shape of the core that would be expected if the stress was removed having reached a point between **0** and **J**, and a point between **J** and **K** on **Figure 11a**. [3]




(The cores at **0** and **L** are drawn for comparison.)

**Figure 11b**

(d) The geological structures formed at **Locality 5** and **Locality 6** in **Rock Unit A** on **Map 1** can be related to the experimental data on **Figure 11a**.

(i) Complete **Table 4** by adding **one** tick (✓) in the **Locality 5 column** to match the geological feature at **Locality 5** to the section of the graph. Tick only **one** box. [1]

| Section of **Figure 11a** | **Locality 5** | **Locality 6** |
|---|---|---|
| Between **0** and **J** | | |
| Between **J** and **K** | | ✓ |
| Between **K** and **L** | | |
| At point **L** | | |

**Table 4**


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(ii) Give a reason for your choice in **Table 4** for **Locality 5** and justify the tick in **Table 4** for **Locality 6**. [2]

Reason for **Locality 5**

.....

.....

Justification for **Locality 6**

.....

.....

(e) Suggest and explain the conditions that caused **Rock Unit A** to behave differently during deformation at **Locality 5** and **Locality 6**. [4]

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**END OF PAPER**



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**Acknowledgement**

**Figure 2b** Photograph Stuart Sutherland



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