Surname	Centre Number	Candidate Number
First name(s)		2

GCE AS

B480U20-1

S25-B480U20-1

MONDAY, 19 MAY 2025 – MORNING

GEOLOGY – AS component 2
Foundation Geology

1 hour 30 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**13**	
2.	**13**	
3.	**19**	
4.	**17**	
5.	**12**	
6.	**16**	
Total	**90**	

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ADDITIONAL MATERIALS

Mineral Data Sheet
A calculator
A ruler
A protractor

INSTRUCTIONS TO CANDIDATES

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.

Answer **all** questions.

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

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 **4** and **6**.

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1. **Figure 1a** shows an internal and external view of fossil **A**.

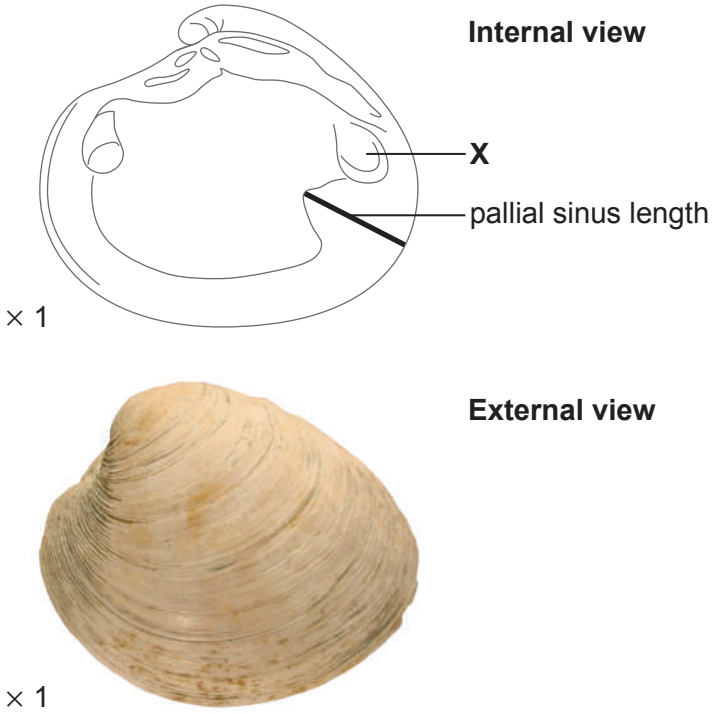


Figure 1a

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

(i) Name the morphological feature labelled **X** on fossil **A**. [1]

.....

(ii) Name the fossil group represented by fossil **A**. [1]

Fossil group .....

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(b) **Figure 1b** shows a method to determine the mode of life of fossil shells, like fossil **A**, using the relationship between a shell's maximum length and its pallial sinus length. The pallial sinus index can be calculated using the formula:

$$\textit{pallial sinus index} = \frac{\textit{pallial sinus length}}{\textit{maximum shell length}}$$

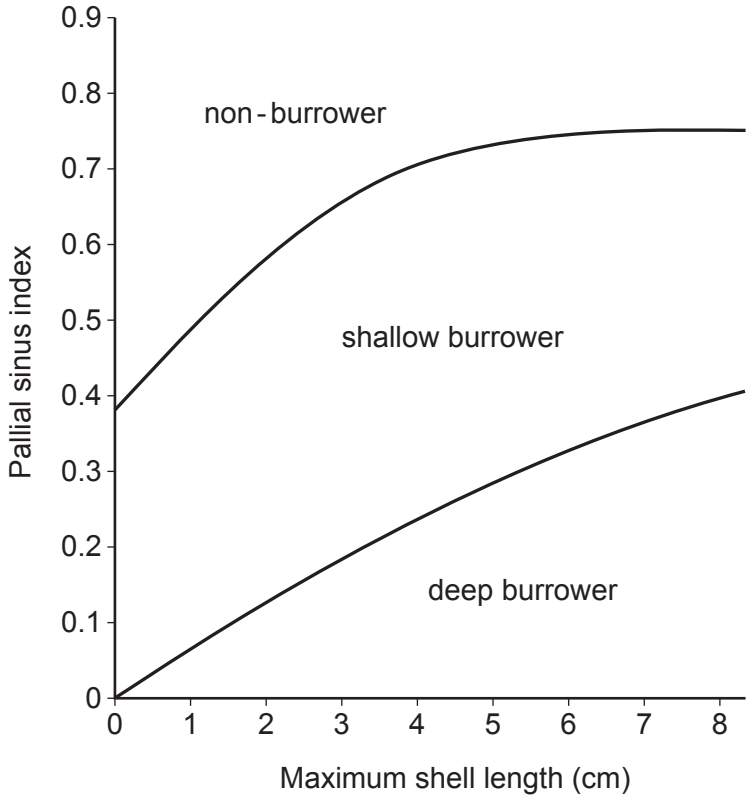


Figure 1b

(i) Calculate the pallial sinus index for fossil **A** in **Figure 1a**. [2]
Show your working.

pallial sinus index .....

(ii) Plot the pallial sinus index data for fossil **A** on **Figure 1b**. [1]
Label your plot **P**.

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(iii) Explain how **one** morphological feature of fossil **A** supports the mode of life indicated by your plot on **Figure 1b**. [2]

Morphological feature .....

Explanation .....

.....

.....

(c) **Figure 1c** shows a fossil assemblage of individuals of the same species collected from the same bedding plane.

fossil **B**:

- original calcite shell now composed of a white mineral with no cleavage, that does not scratch with a steel pin

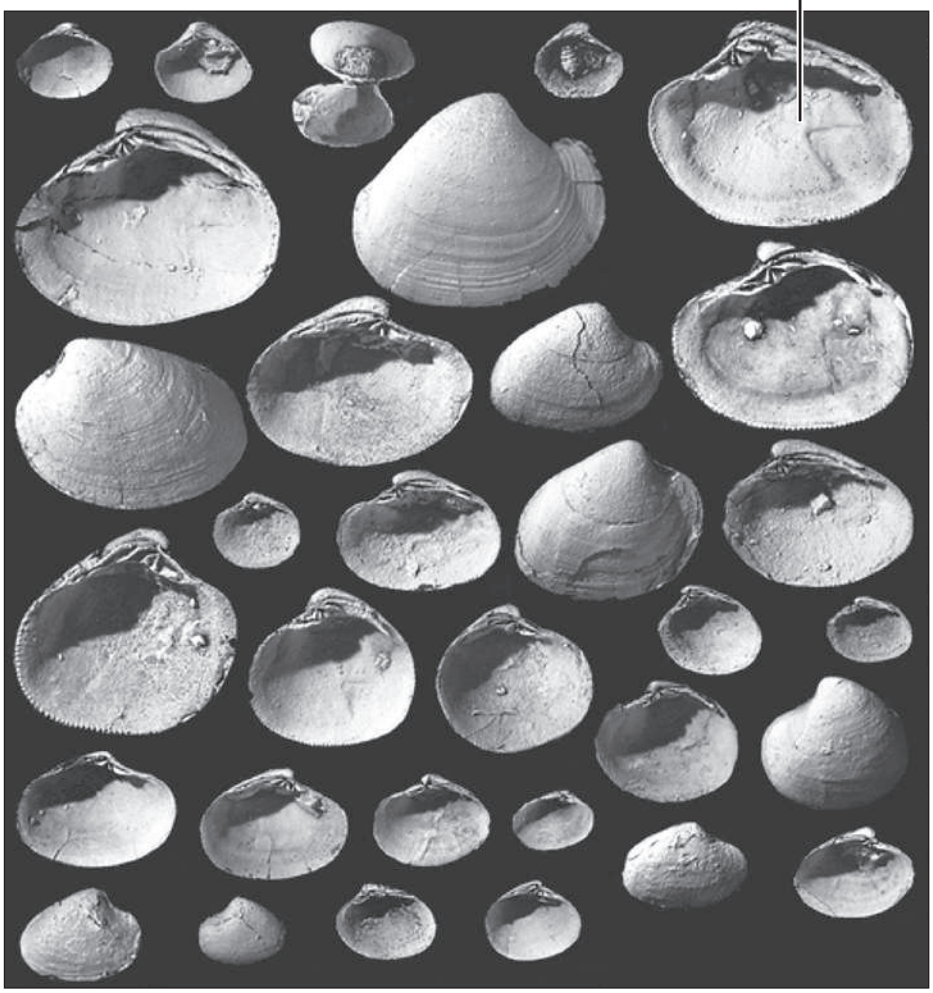


Figure 1c

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(i) State whether the fossils in **Figure 1c** are most likely to have been preserved as a life or a death assemblage.
Explain **two** pieces of evidence to support your answer. [3]

Type of assemblage .....

1. .....

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2. .....

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(ii) Explain the processes that led to the fossilisation of fossil **B** in **Figure 1c**. You may wish to refer to the Mineral Data Sheet. [3]

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2. **Figure 2a** is a graph showing the relationship between silica (SiO_2) content of magmas and their gas content.

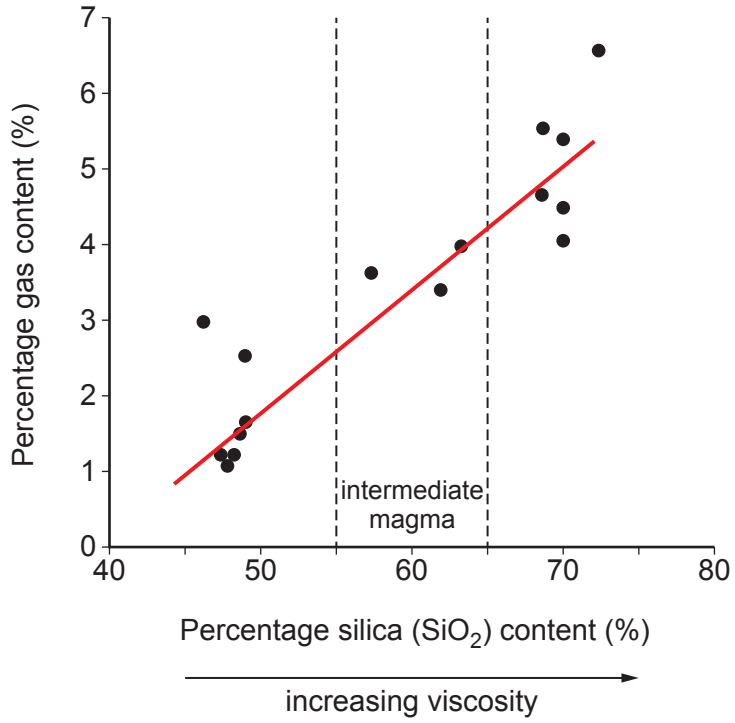


Figure 2a

(a) Refer to **Figure 2a**.
State the range in percentage gas content for magmas with 70% silica. [1]

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(b) **Figure 2b** shows an igneous rock.

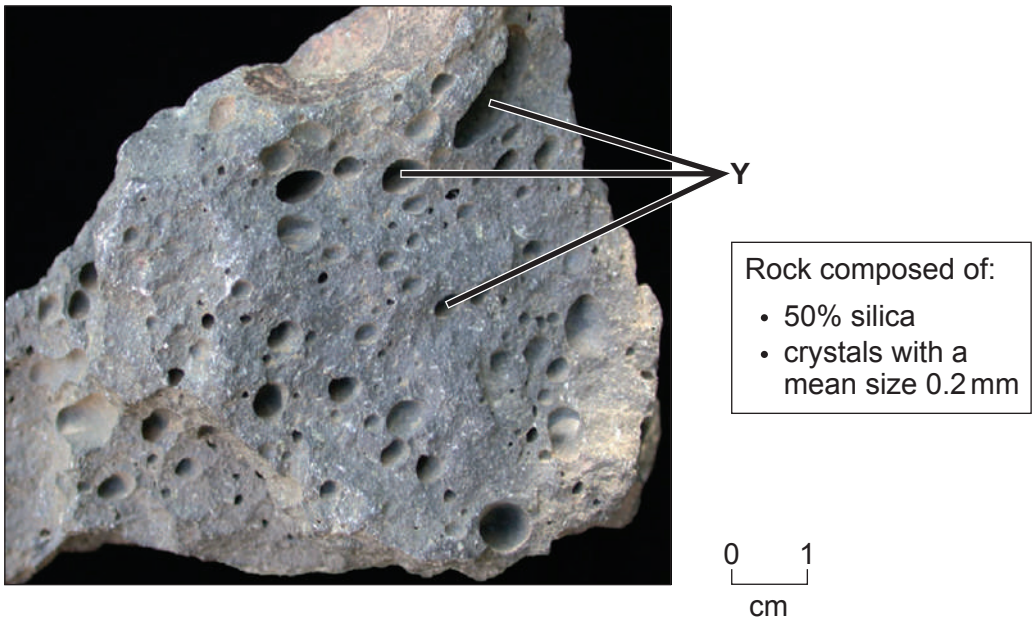


Figure 2b

Refer to **Figure 2a** and **Figure 2b**.

(i) State the name of the rock in **Figure 2b**. [1]

.....

(ii) State the name of the rock texture indicated by the presence of the features labelled **Y**.
Describe how this texture formed. [3]

Texture .....

Formation .....

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(c) **Table 1** shows data from two volcanic eruptions at Mauna Loa and Mount St Helens. **Figure 2c** shows photographs of the two volcanoes.

Volcano	Percentage gas content (%)	Percentage silica (SiO_2) content (%)	Magma type
Mauna Loa	1.4	52	•
Mount St Helens	4	64	•

Table 1



Figure 2c

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Refer to **Figure 2a**, **Table 1** and **Figure 2c**.

(i) Complete **Table 1** to show the magma type (intermediate, silicic or mafic) responsible for the two volcanic eruptions. [1]

(ii) Explain how the composition of the magma has produced two volcanoes of differing **shape** and **width**. [4]

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(d) The study of volcanic gas emissions is one technique used to monitor and predict volcanic eruptions.
Evaluate the usefulness of this technique as a tool for predicting future eruptions. [3]

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3. The Goldschmidt classification system places chemical elements into one of four groups: lithophile, chalcophile, atmophile and siderophile.

(a) Complete **Table 2** by matching each of the four Goldschmidt classification groups with their descriptions. [2]

Description of group	Goldschmidt classification group
Common in the hydrosphere and atmosphere	•
Common in rock forming silicates	•
Common in metallic ores containing sulfur	•
Common in the Earth's core	•

Table 2

(b) **Table 3** shows the composition of the whole Earth, the Earth's crust, and the Allende meteorite, an undifferentiated chondrite, estimated to be 4.567 billion years old. **Figure 3a** shows pie charts of the composition of the Earth's crust and Allende meteorite.

	Element	Whole Earth	Earth's crust	Undifferentiated chondrite meteorite (Allende)
Element %	oxygen	30	46	30
	iron	35	6	•
	silicon	15	28	•
	magnesium	13	4	14
	other	7	16	9
	Total	100	100	100

Table 3

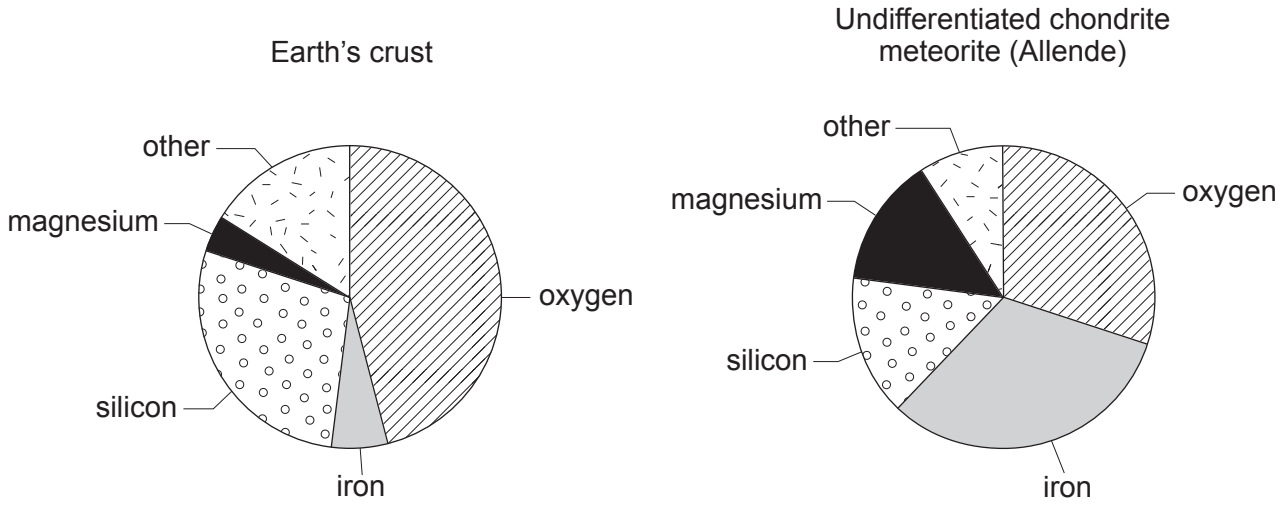


Figure 3a

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Refer to **Table 3** and **Figure 3a**.

(i) Complete **Table 3** by adding the percentages of iron and silicon for the Allende meteorite. [2]

(ii) Explain the:
- similarities between the composition of the whole Earth and the Allende meteorite.
- differences between the composition of the Earth's crust and the Allende meteorite. [3]

Similarities .....

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Differences .....

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(c) **Figure 3b** is a photograph of a mantle xenolith within a volcanic rock.

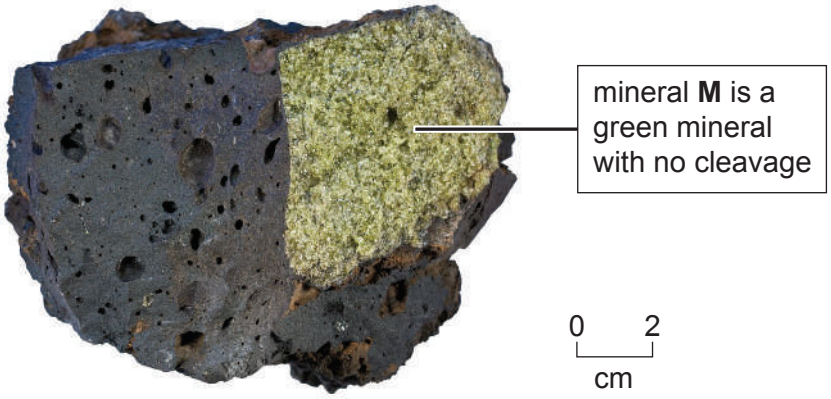


Figure 3b

(i) State the name of mineral **M** in **Figure 3b**.
You may wish to refer to the Mineral Data Sheet. [1]

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(ii) Explain the formation of the mantle xenolith shown in **Figure 3b**. [2]

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(d) **Figure 3c** shows isochrons for samples of the Allende meteorite and the mantle xenolith shown in **Figure 3b**. The starting ratios of $^{143}Nd/^{144}Nd$ and $^{147}Sm/^{144}Nd$ at the time of crystallisation are also shown.
Table 4 contains the half-life values for two radioactive parent isotopes.

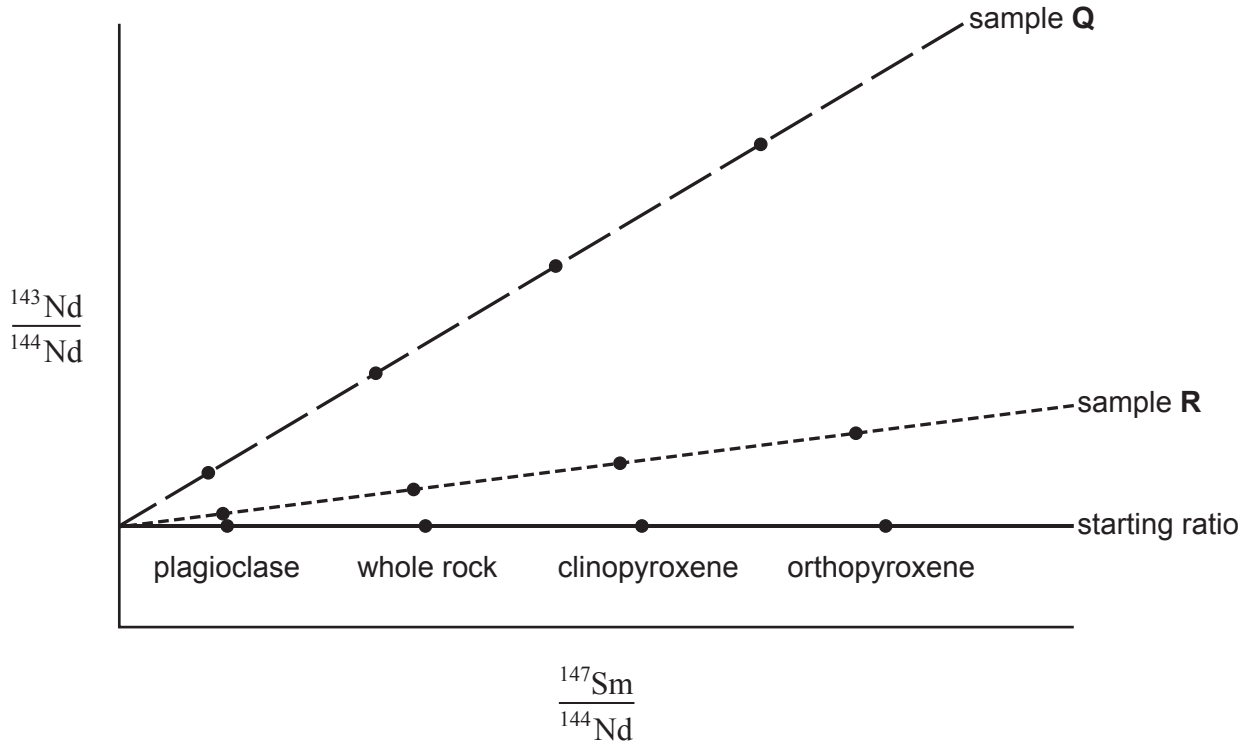


Figure 3c

Parent isotope	Half-life (years)
Carbon-14 (^{14}C)	5730
Samarium-147 (^{147}Sm)	106 billion

Table 4

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Refer to **Figure 3c**.

(i) State which sample (**Q** or **R**) represents the Allende meteorite.
Explain your answer. [2]

Sample .....

Explanation .....

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(ii) State what is meant by the term half-life. [1]

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(iii) Refer to **Table 4**.
Explain why Samarium-147 is used to date the Allende meteorite rather than Carbon-14. [2]

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(e) 'Mantle xenoliths are more useful than meteorites for understanding the composition of the whole Earth.'

Evaluate this statement referring to **Table 3** and your own knowledge. [4]

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Turn over.

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4. **Figure 4a** is a partially completed graphic log.
Figure 4b is a photograph representative of the whole of the missing bed **C** in **Figure 4a**.

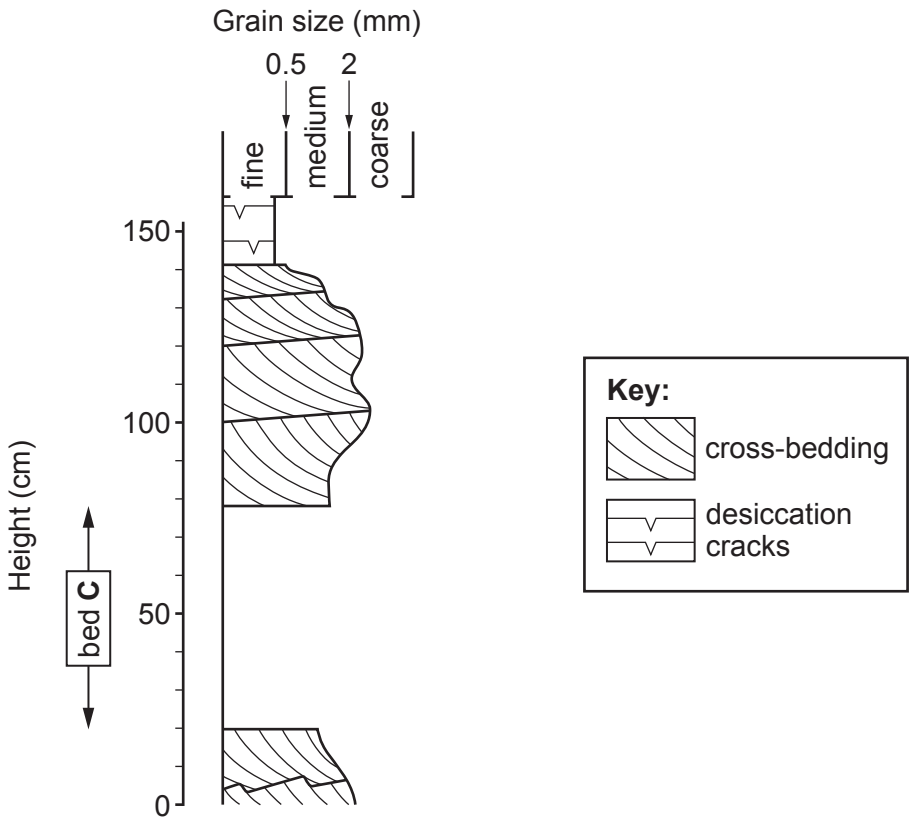


Figure 4a

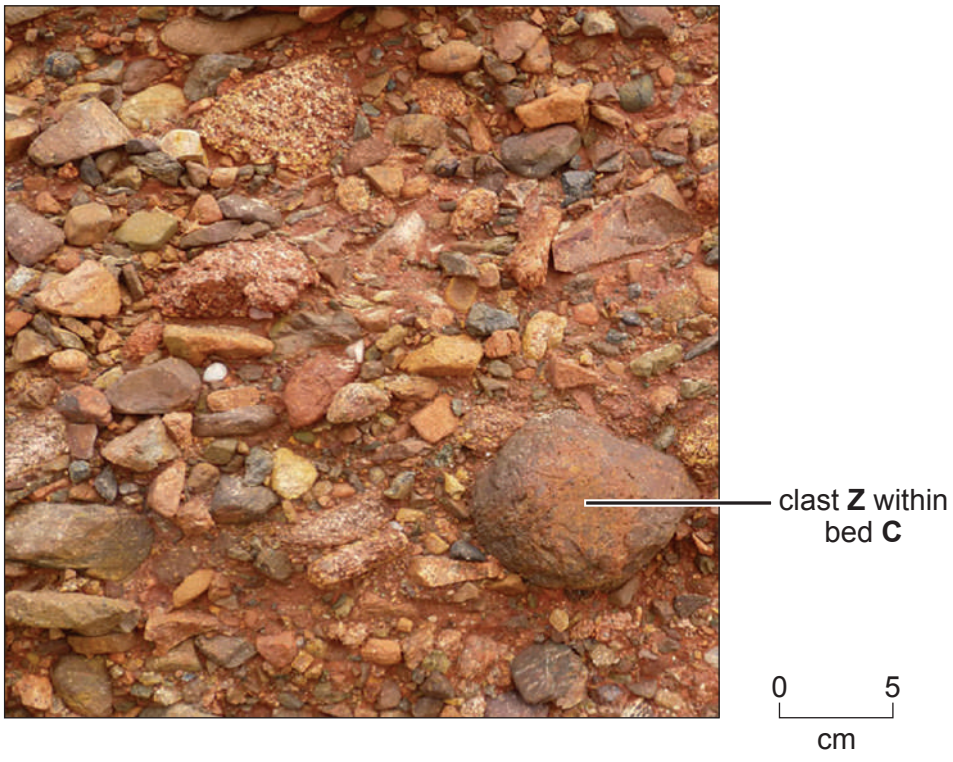


Figure 4b

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(a) (i) Describe the texture of bed **C** as shown in **Figure 4b**. [4]

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(ii) Using **Figure 4b**, complete **Figure 4a** by adding bed **C** to the graphic log. [1]

(b) **Figure 4c** shows the relationship between grain size and the type of transportation at different flow velocities.

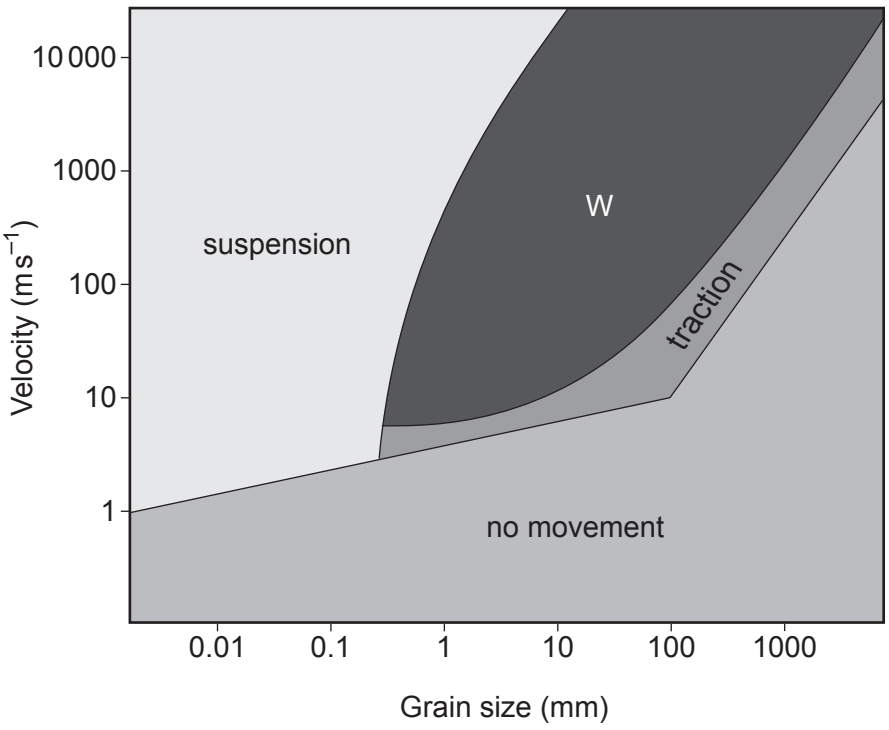


Figure 4c

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(i) State the transport type in the area labelled **W** on **Figure 4c**. [1]

.....

(ii) Using **Figure 4b** and **Figure 4c** complete **Table 5**. [2]

Maximum length of clast **Z**	•
Minimum velocity needed for transportation of clast **Z**	•

Table 5

(iii) A student suggested that bed **C** formed in a high energy environment where traction was the dominant method of transportation.
Evaluate this statement using evidence from **Figure 4b** and **Figure 4c**. [3]

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(c) Refer to **Figure 4a** and **Figure 4b**.

Describe the environments of deposition of the sequence shown in **Figure 4a**.
Explain the evidence for your answer. [6 QER]

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5. **Figure 5a** shows the relationship between changes in global temperature compared to present day and extinction rate.

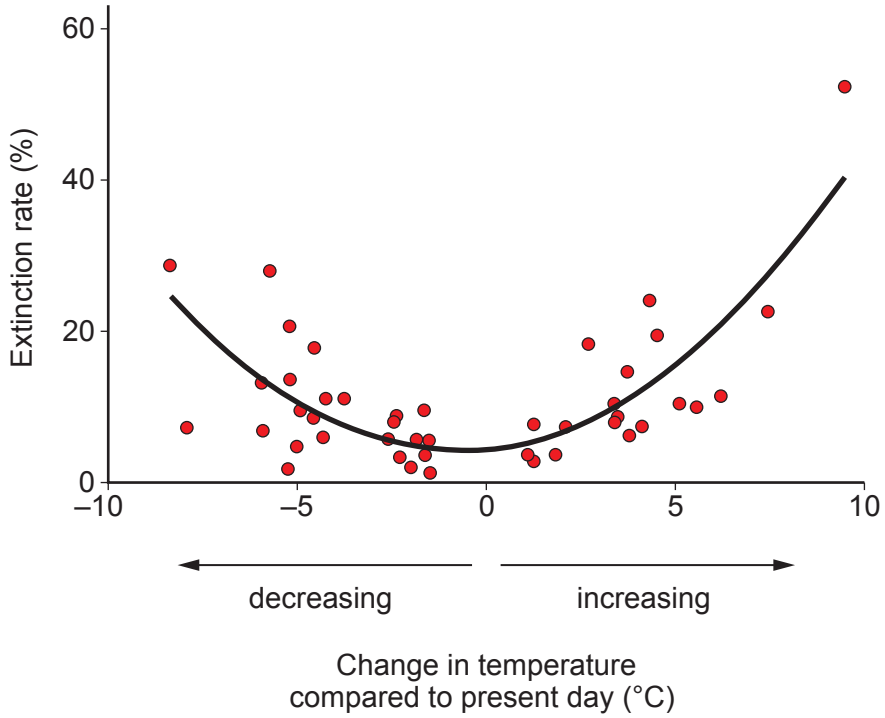


Figure 5a

(a) Describe the relationship between global temperature change and extinction rate shown in **Figure 5a**. [3]

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(b) **Figure 5b** shows the change in extinction rate during different eras of time.

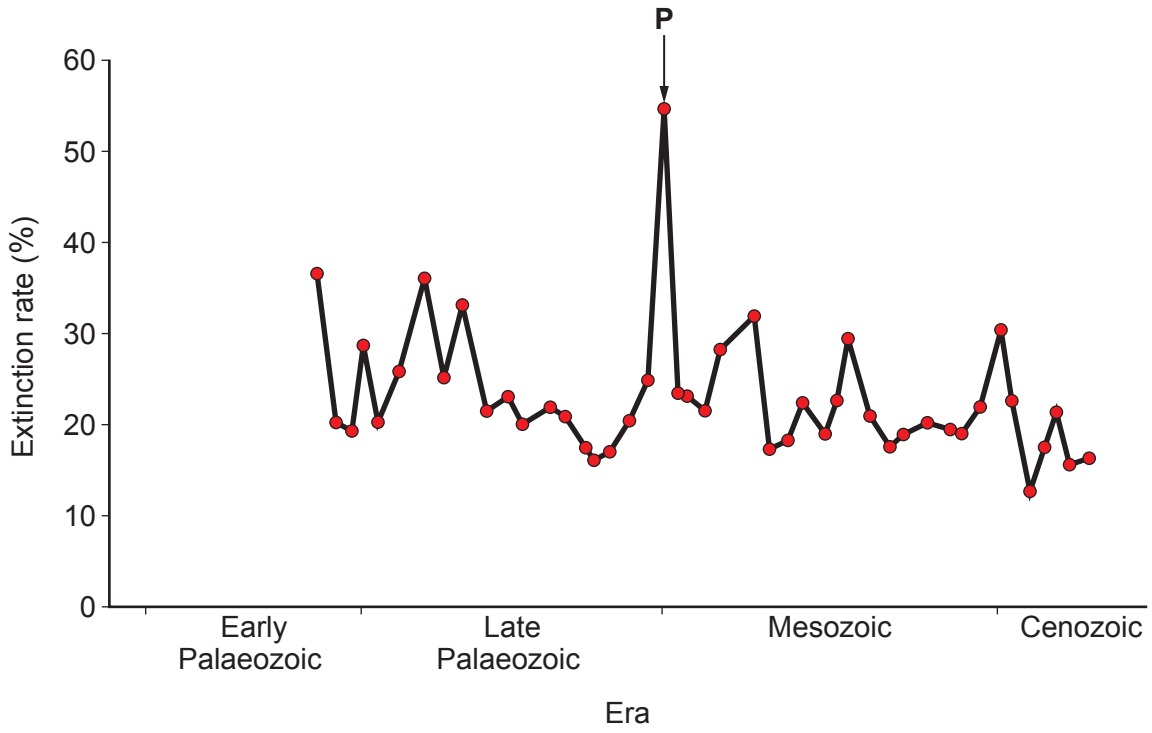


Figure 5b

(i) Point **P** identifies a mass extinction event that separates two geological periods. State the names of the two geological periods. [1]

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(ii) Using **Figure 5b** and your own knowledge, explain why this event is considered a mass extinction. [3]

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(c) **Figure 5c** shows a model of the development of a typical mantle plume considered to be a possible cause of the mass extinction event at point **P** on **Figure 5b**.

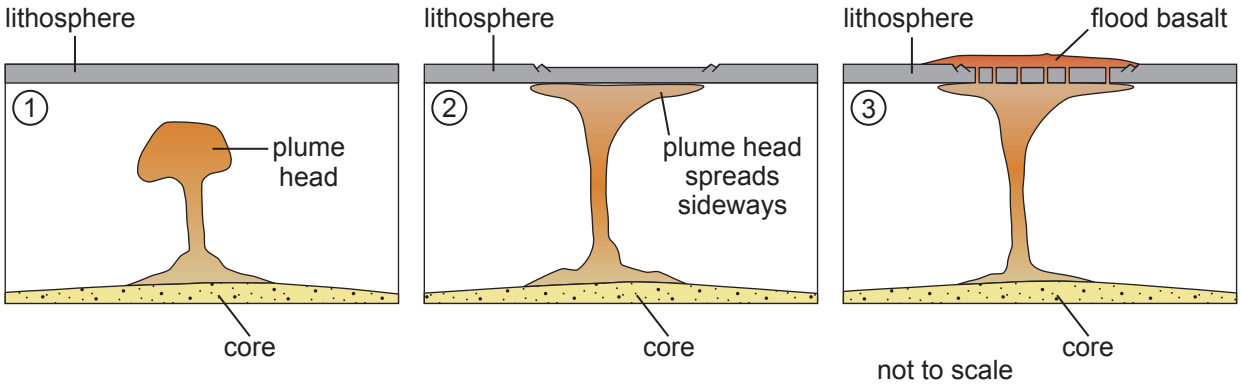


Figure 5c

(i) Explain how partial melting occurs in the rising mantle rocks. [3]

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(ii) Suggest possible reasons why the mantle plume head spreads sideways when it reaches the lithosphere. [2]

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6. **Figure 6a** shows a simplified geological cross-section through part of the Alps.

Figure 6b is a sketch of a photomicrograph of rock unit **D** on **Figure 6a**.

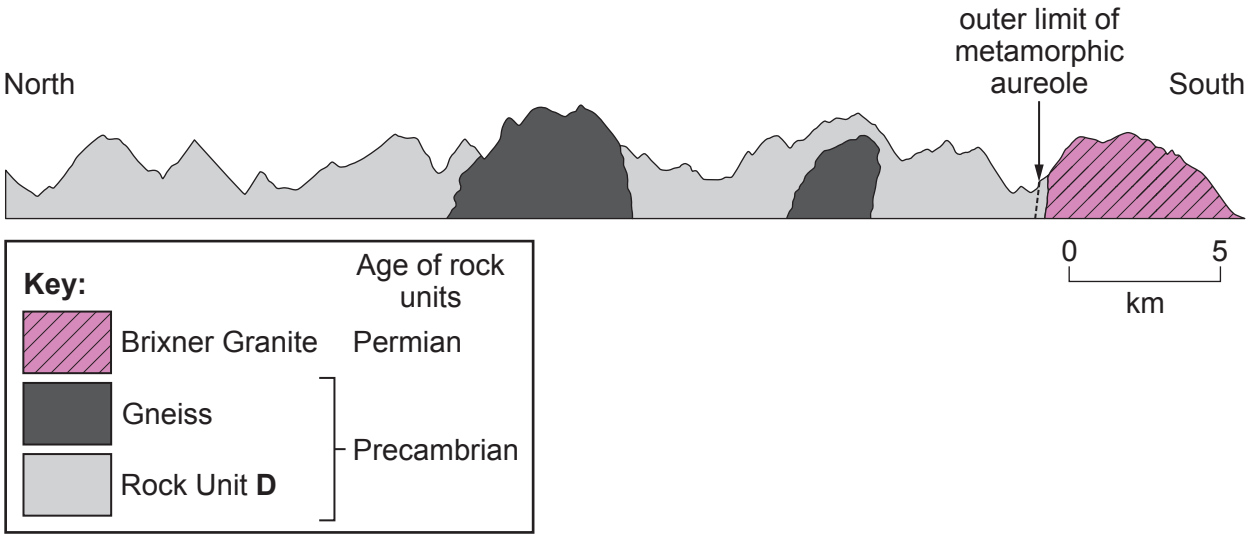


Figure 6a

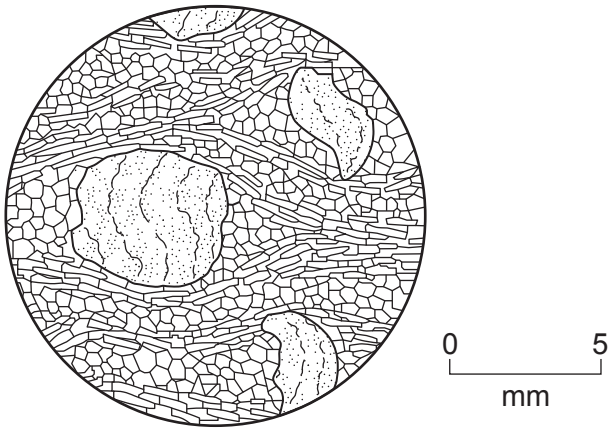


Figure 6b

(a) (i) Describe the texture of rock unit **D** shown in **Figure 6b**. [3]

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(ii) State the name of the rock forming rock unit **D**. [1]

.....

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(b) A sample of the Brixner Granite was found at the southern end of **Figure 6a**. Its texture was described as equicrystalline with coarse, anhedral crystals.

(i) Draw the texture of the Brixner Granite in **Figure 6c**. Add a scale to your diagram. [4]

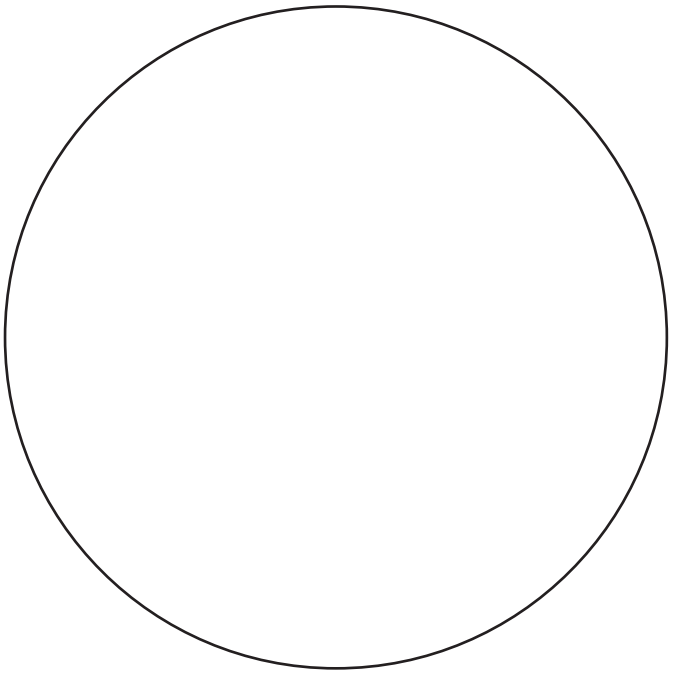


Figure 6c

(ii) Explain what the texture of the Brixner Granite indicates about its cooling history. [2]

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(c) Refer to **Figure 6a**.
Evaluate the statement,'the rocks north of the Brixner Granite are:

- metamorphic rocks
- showing increased metamorphic change from south to north
- formed by contact metamorphism by the Brixner Granite' [6 QER]

END OF PAPER

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Figure 3b https://www.alexstrekeisen. Photograph by Alex Strekeisen
Figure 4b http://www.cl.eps.manchester.ac.uk/medialand/narg/images/research/africa/Morocco-Acknowledgement not found

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