Surname	Centre Number	Candidate Number
Other Names		2

GCE AS – NEW

B480U20-1

S18-B480U20-1

GEOLOGY – AS component 2
Foundation Geology

FRIDAY, 18 MAY 2018 – AFTERNOON

1 hour 30 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**14**	
2.	**11**	
3.	**14**	
4.	**19**	
5.	**15**	
6.	**17**	
Total	**90**	

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ADDITIONAL MATERIALS

In addition to this examination paper, you will need:
the Mineral Data Sheet
a calculator
a protractor

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.
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.

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 **5**.

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Answer **all** *questions in the spaces provided.*

1. **Figure 1a** shows a graptolite specimen preserved in black shale.

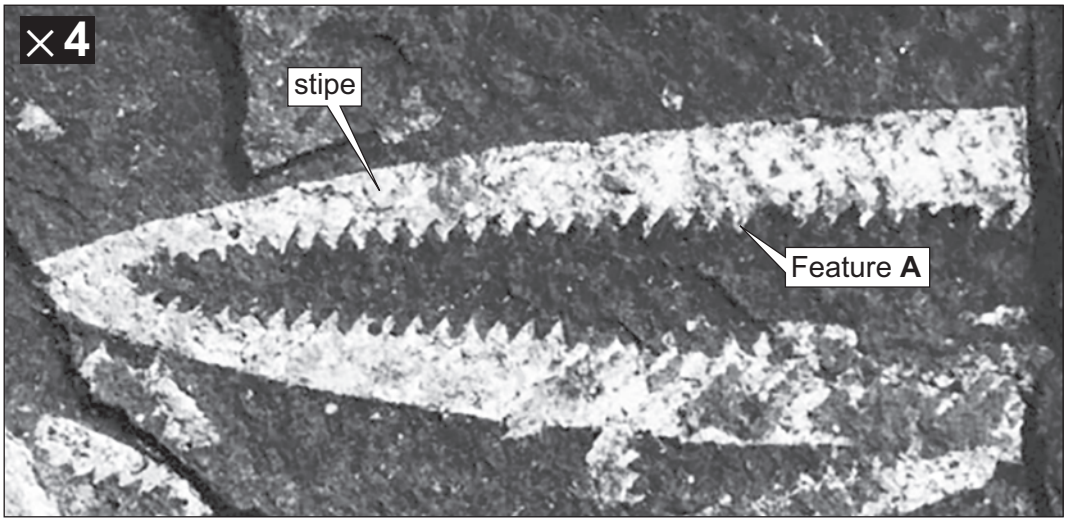

Figure 1a

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

Name morphological Feature **A**. ..... [1]

(ii) Calculate the true length of the stipe labelled on **Figure 1a**. Show your working. [2]

True length of stipe .....

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Figure 1b shows the time ranges for five named graptolites.

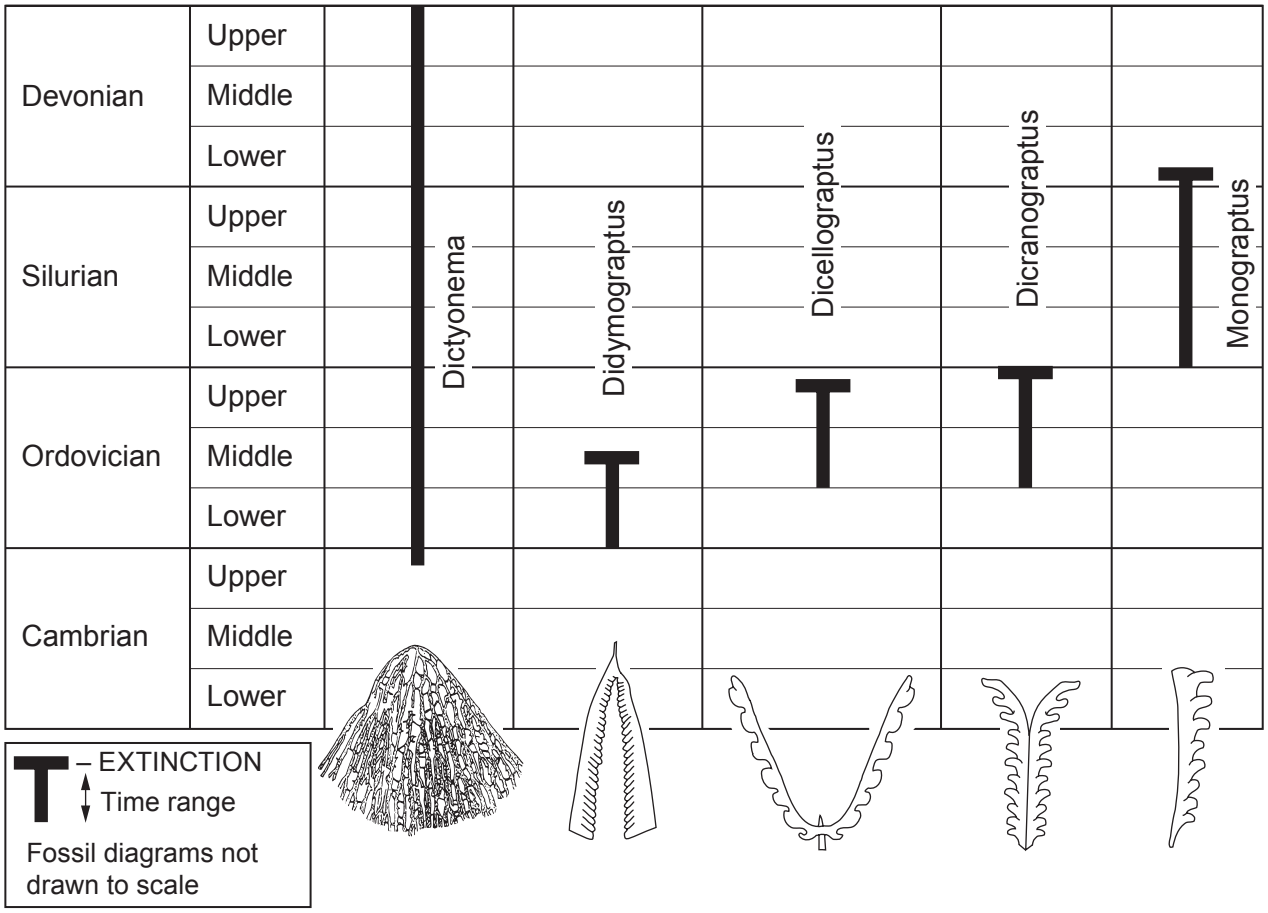

Figure 1b

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

(i) Identify the name of the graptolite shown in **Figure 1a**. [1]

.....

(ii) State when the graptolite shown in **Figure 1a** became extinct. [1]

.....

(c) (i) Refer to **Figure 1b**. Describe **two** differences between Didymograptus and Dicellograptus. [2]

Difference 1 .....

.....

Difference 2 .....

.....

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(ii) Graptolites are useful zone fossils in the Lower Palaeozoic. State **three** characteristics of graptolites that make them suitable for relatively dating rocks. [3]

1 .....

.....

2 .....

.....

3 .....

.....

(d) **Figure 1c** shows a collection of graptolites preserved in black shale with a 1 pence coin for scale. The original organic matter of the graptolites has been replaced by a brass yellow mineral with a greenish black streak.

Figure 1c

(i) Refer to the **Mineral Data Sheet**. Identify the replacement mineral in **Figure 1c**.[1]

.....

(ii) Using three pieces of evidence from **Figure 1c**, explain why the graptolites represent a death assemblage. [3]

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2. **Figure 2a** shows the percentages of the eight most abundant elements in the Earth's crust.

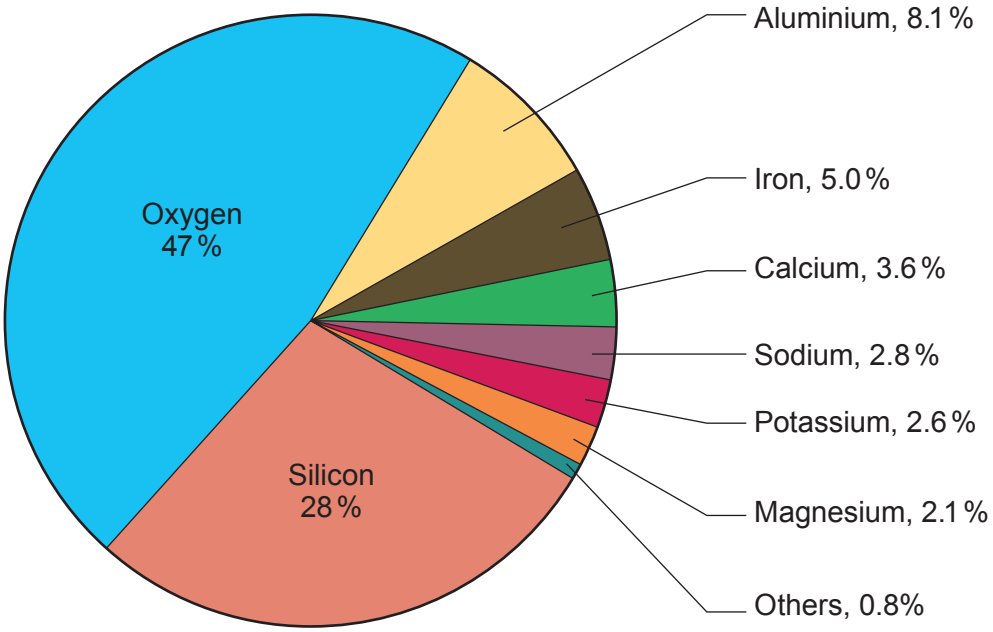

Figure 2a

(a) (i) Refer to **Figure 2a**.

Calculate the percentage of the Earth's crust made up by the **three** most abundant elements. [1]

.....

(ii) The Goldschmidt Classification places chemical elements into one of four groups: lithophile, chalcophile, atmophile and siderophile.

Complete **Table 2b** by matching each of the four terms with their descriptions. [2]

Lithophile **Chalcophile** **Atmophile** **Siderophile**

Heavy metals found in the Earth's core	
Common in rock forming silicates	
Common in the hydrosphere and atmosphere	
In metallic ores containing sulfur	

Table 2b

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(b) **Figure 2c** is a polished surface of an igneous rock with a 20 pence coin for scale.

Figure 2c

(i) Estimate the percentage of the rock (excluding feature **D**) in **Figure 2c** that is made up of pinkish orthoclase feldspar. Tick (✓) only **one** box. [1]

☐ 20 % ☐ 40 % ☐ 60 % ☐ 80 %

(ii) Which **one** of the minerals shown in **Figure 2c** (excluding feature **D**) was the first to crystallise from the magma? Give **two** reasons to support your answer. [3]

First mineral to crystallise .....

Reason 1 .....

.....

Reason 2 .....

.....

(iii) Feature **D** is crystalline, mafic and fine-grained. Name the rock forming feature **D**. [1]

.....

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(iv) Suggest a name for feature **D** in **Figure 2c** and give **one** possible explanation for its origin/formation. [3]

Name of feature **D** .....

Explanation .....

.....

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Turn over.

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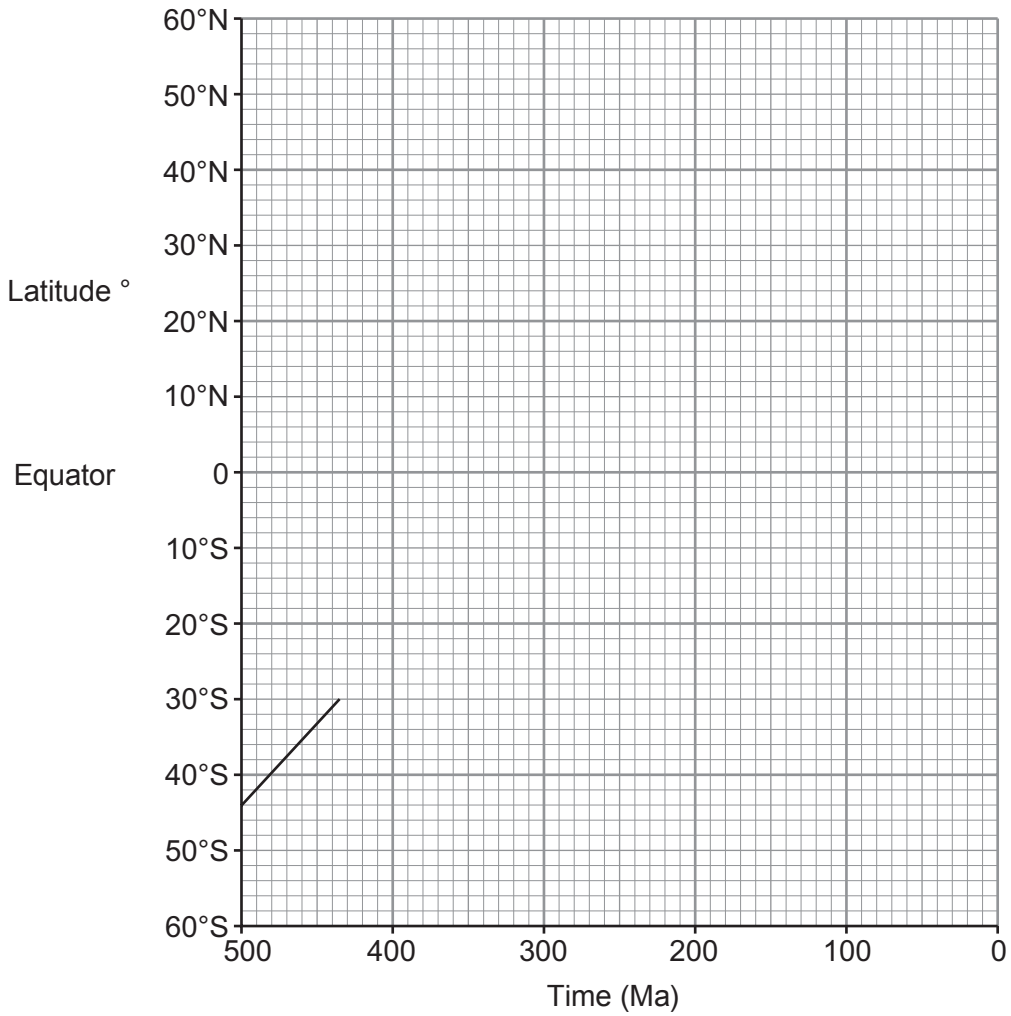
3. **Table 3a** shows the changing latitudinal position of the UK from 435Ma to 65Ma based on palaeomagnetic evidence from basaltic rocks.

Age Ma	435	396	345	280	230	195	140	65
Latitude °North/South	30° South	15° South	10° South	0° Equator	25° North	35° North	40° North	50° North

Table 3a

(a) (i) Use the data in **Table 3a** to complete the graph below. Plot and draw a line to show the change in the latitude of the UK between 435Ma and 65Ma. [3]



(ii) Refer to your graph above. Describe the general pattern of latitudinal change of the UK from 500Ma to 65Ma. [2]

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(iii) Calculate the mean rate of latitudinal change in degrees per 10 million years between 280Ma and 65Ma.

Show your working [3]

..... °/10Ma

(b) Describe what the palaeomagnetic evidence reveals about the changes in the longitude (East/West movement) of the UK over the same period of time as shown in **Table 3a**. Give a reason for your answer. [2]

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(c) **Table 3b** shows details of selected sedimentary rock types found in the UK between 400Ma and 100Ma.

100 Ma	Chalk in Southern England
230 Ma	Dune bedded red sandstones, breccias and evaporites in Northern England
280 Ma	Limestone with colonial corals overlain by coal seams in South Wales
400 Ma	Red sandstones and breccias in Scotland

Table 3b

Refer to **Tables 3a** and **3b**

Describe and explain how the information shown in **Table 3b** supports the palaeomagnetic evidence in **Table 3a** for the changing latitude of the UK through geological time. [4]

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4. **Figure 4a** is a simplified diagram of an ocean ridge with the pattern of magnetic anomalies in the igneous rocks of the ocean crust displayed. **Figure 4b** is a time scale to show the age of magnetic reversals over the last 2Ma.

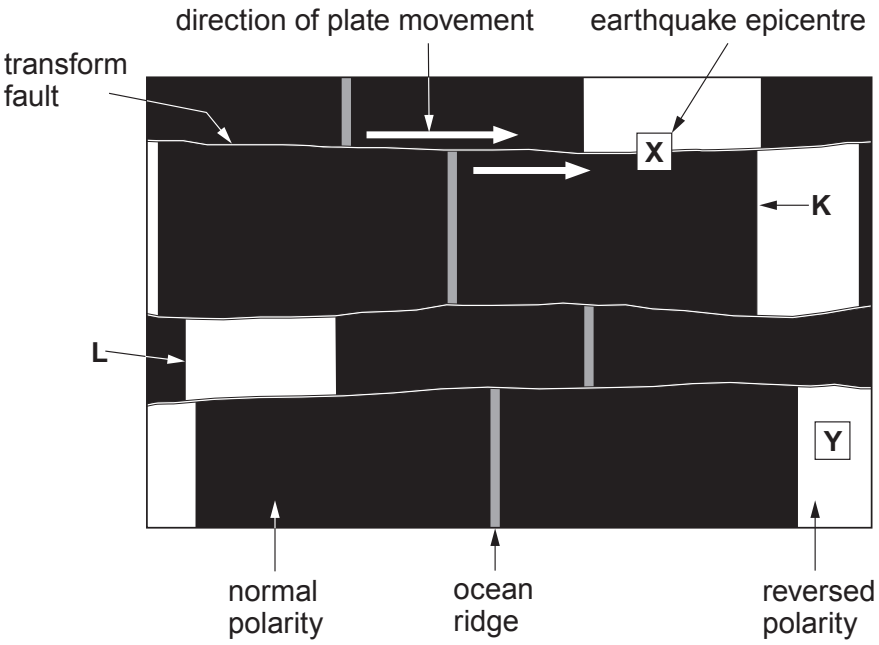

Figure 4a
(not to scale)

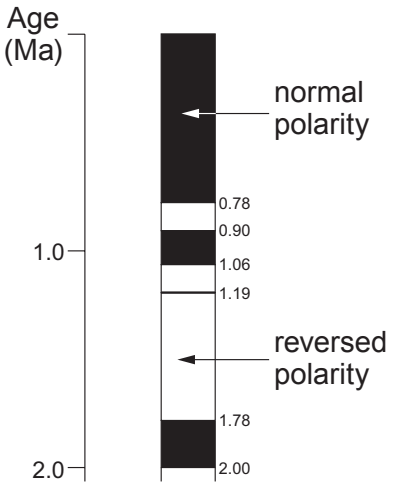

Figure 4b

(a) Refer to **Figures 4a** and **4b**.

(i) Name the type of plate margin represented by **Figure 4a**. [1]

.....

(ii) State the age of the ocean crust at points **K** and **L** on **Figure 4a**. [2]

K .....Ma **L** .....Ma

(iii) Describe the pattern shown by the magnetic anomalies in **Figure 4a**. [3]

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(b) Refer to **Figure 4b**.

(i) State the number of magnetic reversals that have occurred during the last 2Ma. [1]

Number of reversals .....

(ii) Calculate the mean length of time between reversals during the last 2Ma. [1]

Mean length of time between reversals ..... Ma

(iii) Explain how a record of the changing magnetic polarity of the Earth can be preserved in the rocks of the oceanic crust as shown on **Figure 4a**. [3]

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(c) Explain the cause of the shallow-focus earthquake at the point marked **X** on **Figure 4a**. [2]

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(d) The oceanic crust at location **Y** on **Figure 4a** is 7km thick, has a layered structure and is mafic in composition. Describe and explain how this layered structure and composition is formed at ocean ridges. You may wish to include an annotated diagram in your answer.
[6 QER]

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5. **Figure 5a** is a field sketch of landforms in part of a hot desert. The sketch is not to scale.

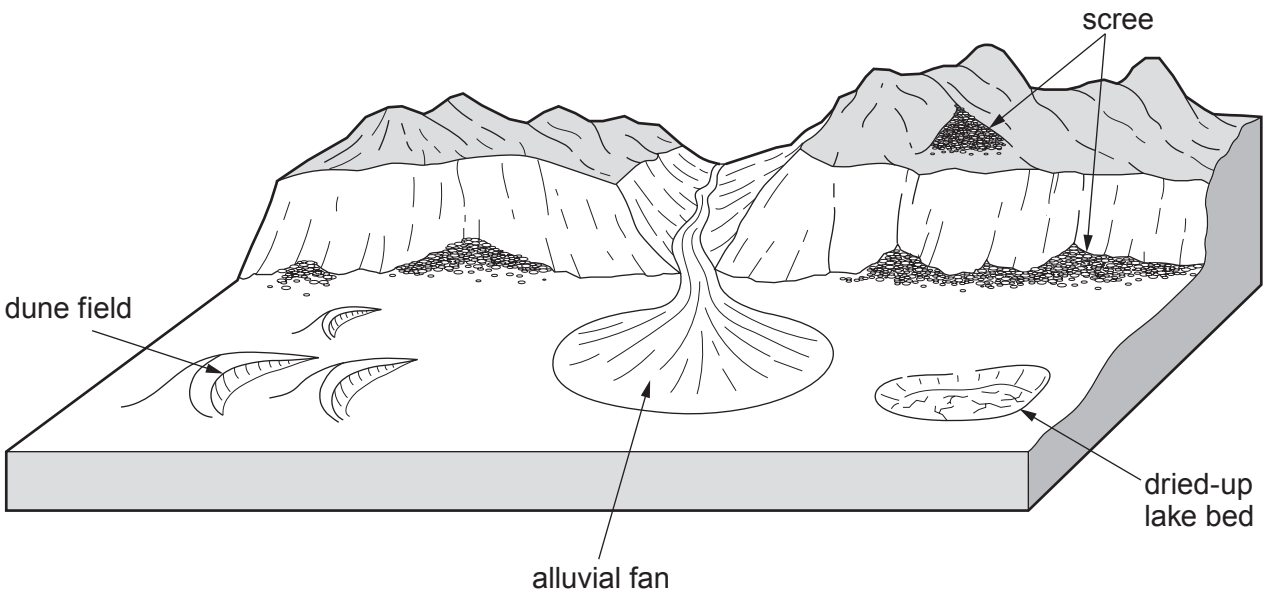

Figure 5a

(a) (i) Name and describe **one** weathering process responsible for the formation of scree in **Figure 5a**. [3]

Name of process .....

Description .....

.....

.....

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Figure 5b shows **sediment** typical of **one** of the landforms named in **Figure 5a**.

Figure 5b

(b) (i) Describe the texture shown by the **sediment** in **Figure 5b**. [3]

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(ii) The **sediment** in **Figure 5b** is a characteristic sample taken from one of the landforms named in **Figure 5a**. Identify the landform and give **two** reasons to support your answer. [3]

Name of landform .....

Reason 1 .....

.....

Reason 2 .....

.....

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(c) Sedimentary grains are transported by both wind and water in the hot desert environment in **Figure 5a**. Assess the relative effectiveness of wind and water in the sorting and rounding of these transported sedimentary grains. Give reasons to support your answer. [6 QER]

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6. **Figure 6a** is a geological cross-section that shows the true dip of the beds. Vertical and horizontal scales are the same. **Table 6b** shows details of depths and rock types encountered in borehole **Q**.

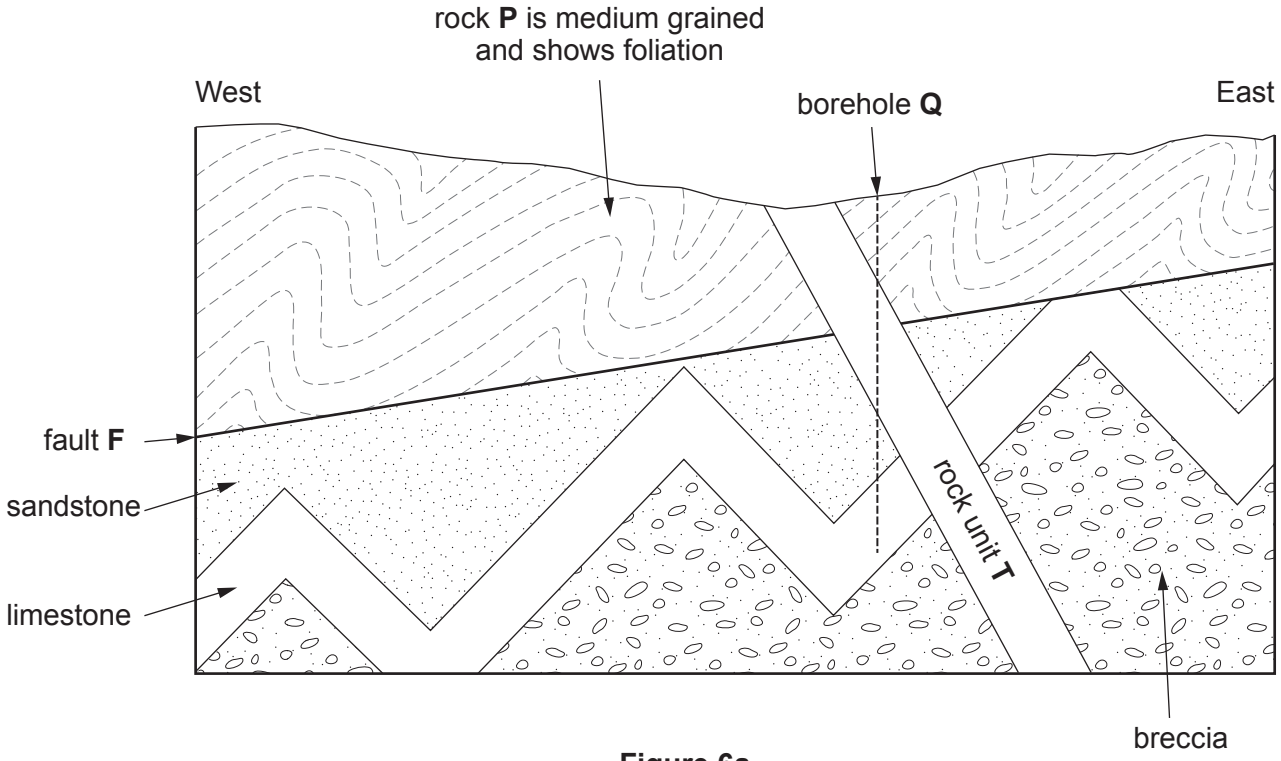

Figure 6a

Depth from the surface in borehole **Q**
Top surface of rock unit **T** – 23 metres
Bottom surface of rock unit **T** – 39 metres

Table 6b

(a) (i) Suggest a name for rock **P** shown in **Figure 6a**. [1]

.....

(ii) State the angle and direction of dip of fault **F** shown in **Figure 6a**. [2]

Angle of dip of fault **F** .....°

Dip direction of fault **F** .....

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(b) (i) Name the geological structure formed by rock unit **T** in **Figure 6a**. Give **two** reasons for your answer. [3]

Name of structure formed by rock unit **T** .....

Reason 1 .....

.....

Reason 2 .....

.....

(ii) Using the information from **Figure 6a** and **Table 6b** calculate the true thickness of rock unit **T** using the following formula. Show your working. [3]

true thickness of **T** = vertical thickness of **T** × cos angle of dip of **T**

True thickness of rock unit **T** ..... m

(c) Describe the folding in the sedimentary rocks below fault **F** shown in **Figure 6a**. You may wish to refer to: [4]

- types of folds
- symmetry of folds
- strike and dip values of limbs
- axial planes

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(d) A student concluded that "fault **F** in **Figure 6a** is a normal fault because rock **P** is the hanging wall and has been downthrown". Critically evaluate this conclusion. [4]

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END OF PAPER

Acknowledgements

Figure 1a https://www.britannica.com/animal
Figure 2a https://upscstudysharing.wordpress.com
Figure 5b https://www.google.co.uk

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