Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

C480UA0-1

S19-C480UA0-1

GEOLOGY – Component 1
Geological Principles
(Paper version of on-screen assessment)

MONDAY, 20 MAY 2019 – AFTERNOON

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**17**	
2.	**12**	
3.	**14**	
4.	**17**	
5.	**7**	
6.	**13**	
Total	**80**	

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ADDITIONAL MATERIALS

In addition to this examination paper you will need:
- the Data Sheet
- a calculator
- a ruler.

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 **2** and **4**.

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Answer **all** *questions.*

1. **Figure 1a** shows a rock outcrop along the east coast of Scotland.

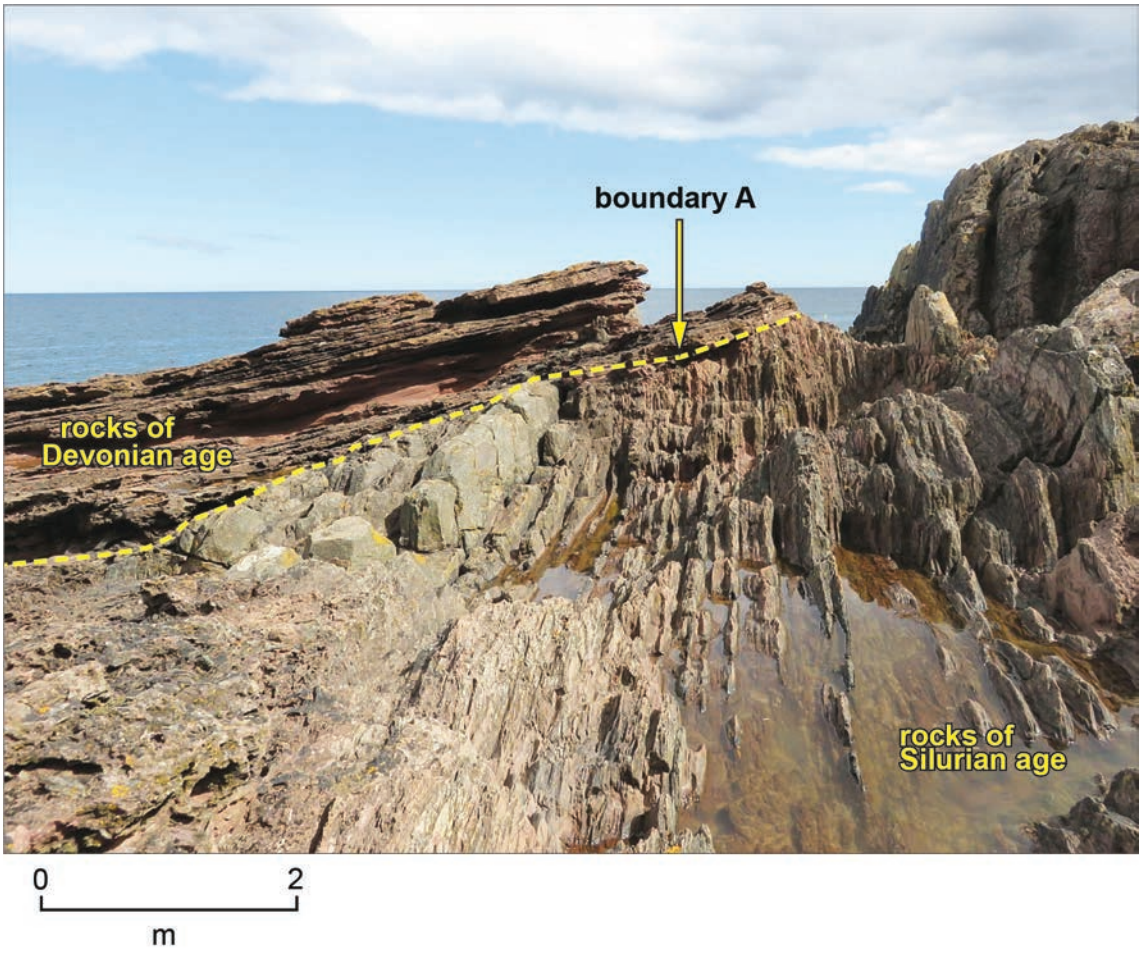

Figure 1a

Refer to **Figure 1a**.

(a) (i) State the approximate angle of dip of the Silurian rocks. Tick (✓) only **one** box. [1]

0° ☐

15° ☐

45° ☐

60° ☐

90° ☐

(ii) Using the Data Sheet state the geological era to which the Silurian and Devonian rocks belong. [1]

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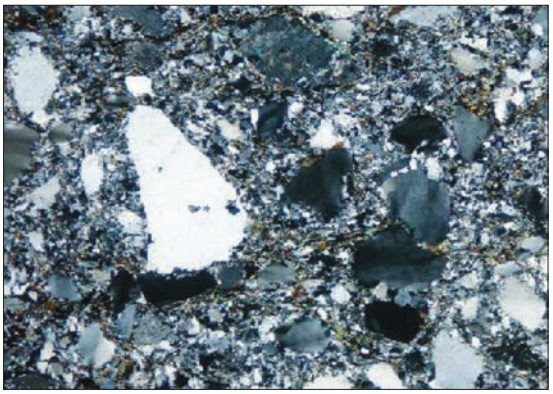
Figures 1b and **1c** are microscope images of the Silurian and Devonian rocks shown in **Figure 1a**. Note the scale bars in each figure are 1 mm in length.



Silurian rock comprises rock fragments, quartz, feldspar and a clay matrix

Figure 1b

Devonian rock comprises quartz grains and a reddish-brown cement

Figure 1c

Refer to **Figure 1b**.

(b) (i) Describe the texture of the Silurian rock. Tick (✓) only **two** boxes. [2]

- crystalline ☐
- poorly sorted ☐
- coarse grained ☐
- angular clasts ☐
- foliated ☐
- porphyritic ☐

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(ii) State the name of the Silurian rock shown in **Figure 1b** and describe the environment in which it was most likely deposited. [4]

Name of rock .....

Environment of deposition

.....

.....

.....

.....

Refer to **Figures 1b** and **1c**.

(c) (i) State which **two** of the following are correct. Tick (✓) only **two** boxes. [2]

the grains in the Devonian rock have undergone much greater transport than the grains in the Silurian rock	☐
the Devonian rock has a higher percentage of feldspar than the Silurian rock	☐
the Devonian rock is better sorted than the Silurian rock	☐
the Devonian rock was more likely to have formed beneath an ice sheet than the Silurian rock	☐
the Silurian rock has more rounded grains than the Devonian rock	☐
the Silurian rock has more haematite than the Devonian rock	☐

(ii) Explain why the Silurian and Devonian rocks shown in **Figures 1a**, **1b** and **1c** do not contain fossils. [2]

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(d) (i) State the most appropriate name for **boundary A** shown in **Figure 1a**. [1]
Tick (✓) only **one** box.

bedding plane	☐
fault	☐
joint	☐
unconformity	☐
lamination	☐

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(ii) James Hutton used the rock outcrop shown in **Figure 1a** to demonstrate the concept of Deep Time. Explain the series of events that have taken place over time to create **boundary A**. [4]

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2. **Figure 2** shows part of the surface of Mars with the Hadley Crater and several other craters.

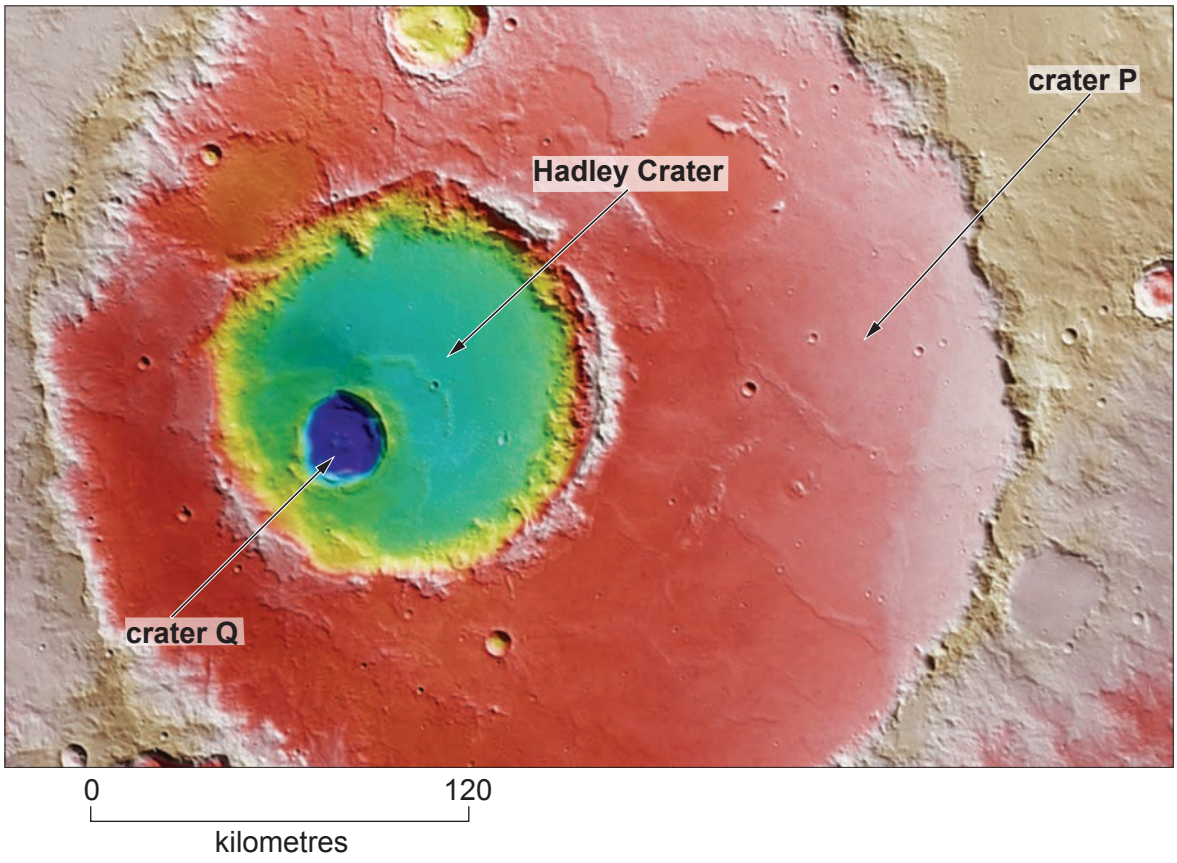

Figure 2

(a) (i) State the most likely origin of the craters shown in **Figure 2**. [1]
Tick (✓) only **one** box.

volcanic eruptions ☐

meteorite/asteroid impacts ☐

landslides ☐

faulting ☐

erosion ☐

(ii) State which **one** of the following terms best describes the shape of the craters shown in **Figure 2**. Tick (✓) only **one** box. [1]

circular ☐

rectangular ☐

irregular ☐

polygonal ☐

spherical ☐

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(iii) Calculate the area of the Hadley Crater shown in **Figure 2**.

Show your working. Formula to calculate area is $A = \pi r^2$ [2]

A = area	r = radius	π = 3.142

..... km^2

(iv) Complete **Table 2** to show the most likely age order of the Hadley Crater and craters **P** and **Q**. [1]

youngest ↑	
oldest	

Table 2

(v) Name the geological principle used to determine the age order of the craters in **Figure 2**. Tick (✓) only **one** box. [1]

- original horizontality ☐
- included fragments ☐
- cross cutting relationships ☐
- uniformitarianism ☐
- radiometric dating ☐

(b) Explain why the craters on Mars shown in **Figure 2** are numerous and well preserved whilst those on Earth tend to be rare and poorly preserved. [6 QER]

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3. **Figure 3a** shows three fossils **A**, **B** and **C** and their geological ages.

Figure 3b is a geological map of the area from where the three fossils were collected.

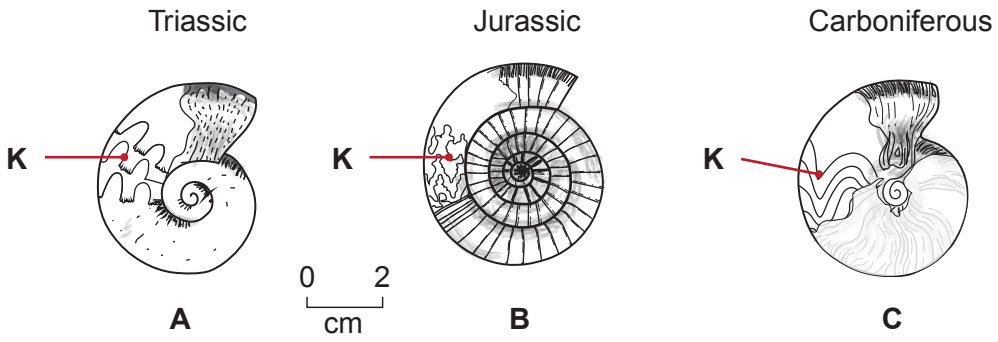

Figure 3a

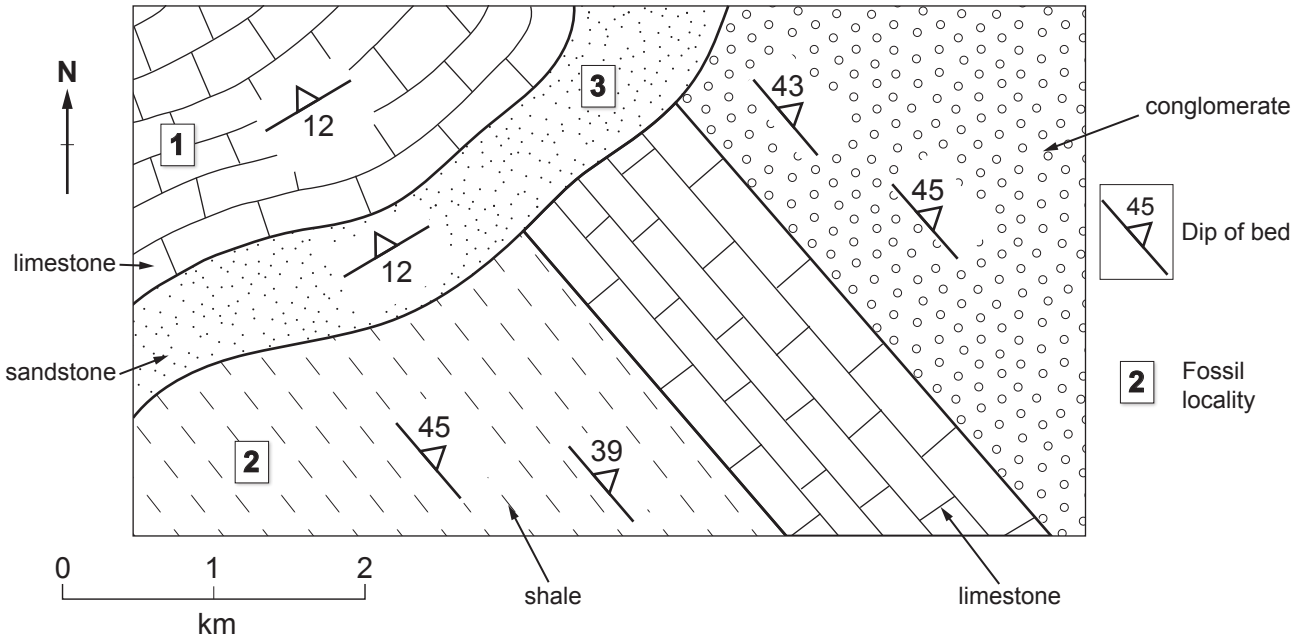

Figure 3b

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

(a) (i) Calculate the mean angle of dip of the beds that strike **NW-SE** in **Figure 3b**. [1]

.....°

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(ii) State the group of organisms to which fossils **A**, **B** and **C** belong.
Tick (✓) only **one** box. [1]

graptolites ☐

trilobites ☐

corals ☐

cephalopods ☐

reptiles ☐

(iii) State the name of the feature labelled **K** on the fossils in **Figure 3a**.
Tick (✓) only **one** box. [1]

stipe ☐

theca ☐

suture line ☐

stem ☐

eye ☐

(iv) State which of the fossils (**A**, **B** or **C**) is a *goniatite*. [2]

Give a reason to support your answer.

State **A**, **B** or **C** ☐

Reason .....

.....

(v) Fossils **A**, **B** and **C** are useful zone fossils and are used in the relative dating of rocks.
State **three** characteristics of these fossils which make them suitable as zone fossils. [3]

1. .....

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2. .....

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3. .....

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(b) The three fossils **A**, **B** and **C** were collected from the three localities labelled **1**, **2** and **3** on **Figure 3b**. Match the fossils (**A**, **B** or **C**) to their most likely localities (**1**, **2** or **3**) based on relative ages. In each case explain how you used the information in **Figures 3a** and **3b** to make your decision. You may wish to refer to the Data Sheet. [6]

fossil **A** locality ☐

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fossil **B** locality ☐

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fossil **C** locality ☐

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4. **Figure 4** is a map showing the plate tectonic features of New Zealand.

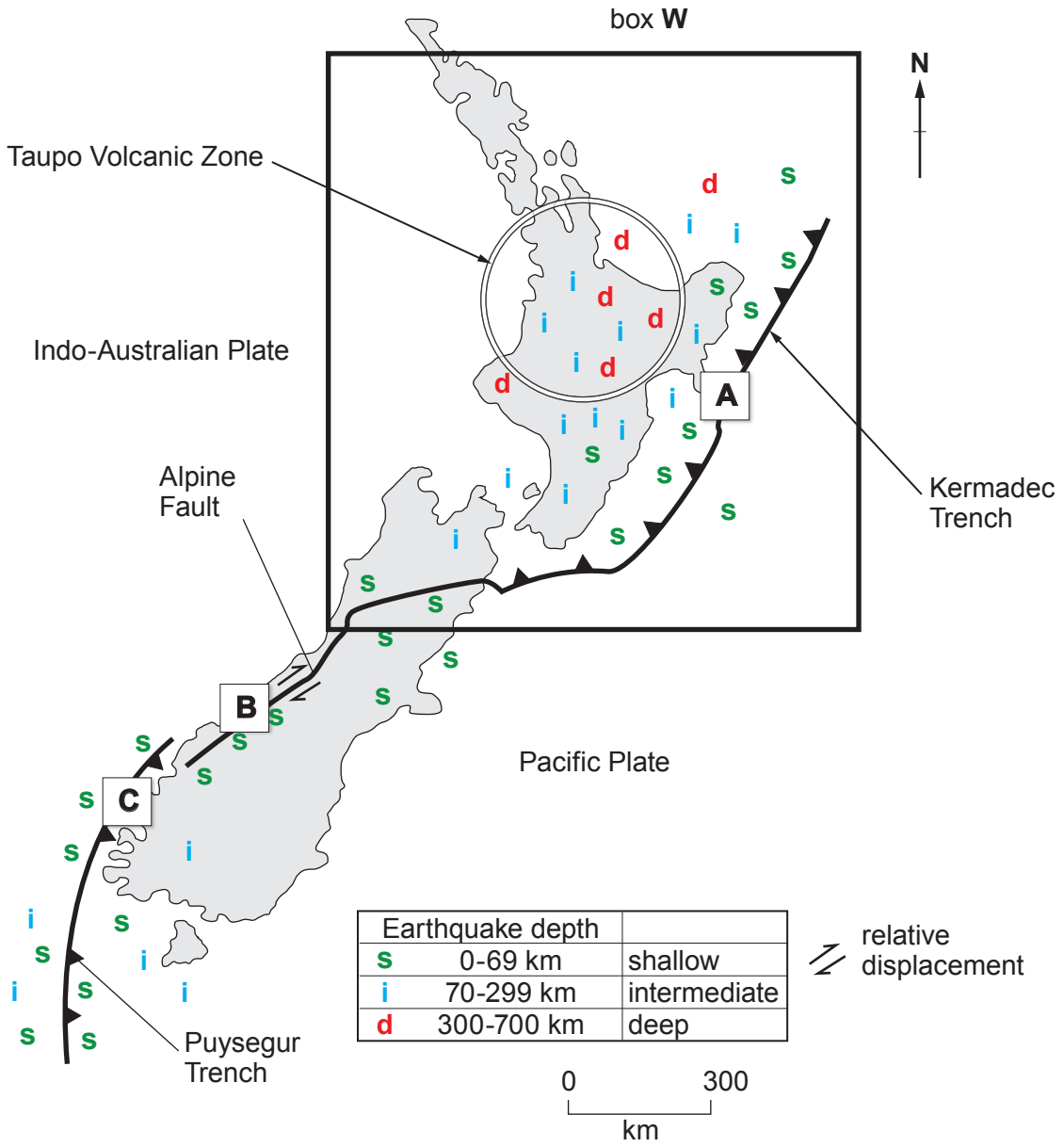

Figure 4

Refer to **Figure 4**.

(a) Draw a line between each of the locations **A**, **B** and **C** and the appropriate type of plate boundary. You may use each plate boundary type once, more than once, or not at all.

[3]

	divergent plate boundary
Location **A**	convergent ocean-ocean plate boundary
Location **B**	convergent ocean-continent plate boundary
Location **C**	convergent continent-continent plate boundary
	conservative plate boundary

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(b) Box **W** in **Figure 4** shows the distribution and depth of earthquakes in New Zealand of magnitude 5.5 and higher.

(i) State which **two** of the following statements are **correct** regarding the pattern of earthquakes shown in box **W**. Tick (✓) only **two** boxes. [2]

shallow focus earthquakes are found closest to the ocean trench	☐
deep focus earthquakes do not occur on the Indo-Australian Plate	☐
intermediate focus earthquakes are common along the Alpine Fault	☐
earthquakes increase in depth from the north west to the south east	☐
very few earthquakes occur to the north west of the Kermadec Trench	☐
earthquakes increase in depth from the south east to north west	☐

(ii) Explain why earthquakes are common to the north west of the Kermadec Trench. [2]

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(iii) The displacement along the Alpine Fault has been measured as 700 kilometres over the last 25 million years. Calculate the average rate of movement of the Alpine Fault per year over this time period in $cmyr^{-1}$. Show your working. [2]

..... $cmyr^{-1}$

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(iv) The Alpine Fault connects the Kermadec Trench in the north to the Puysegur Trench in the south. Indicate using **Figure 4** only, which **two** of the following statements are **incorrect** regarding the nature of the Alpine Fault. Tick (✓) only **two** boxes. [2]

thrust fault	☐
strike-slip fault	☐
shows horizontal displacement	☐
shows movement to the right	☐
formed by volcanic activity	☐
formed by shear stress	☐

(c) Give reasons for the location of the Taupo volcanic zone in **Figure 4** and explain why the volcanoes have violent eruptions. [6 QER]

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5. **Figure 5a** shows a mineral vein exposed in a cliff.

Figure 5b shows further detail of the mineral vein.

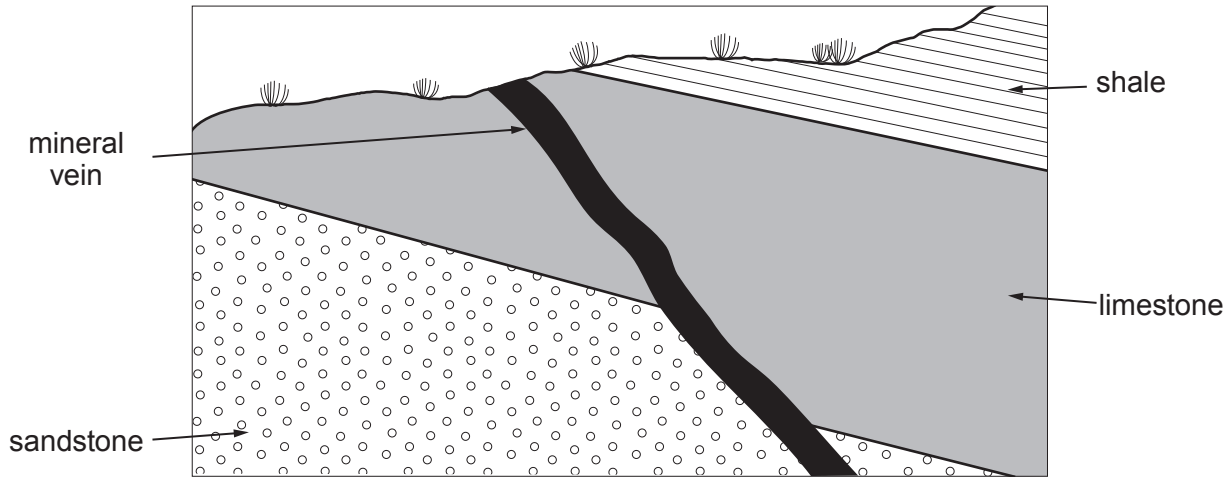

Figure 5a

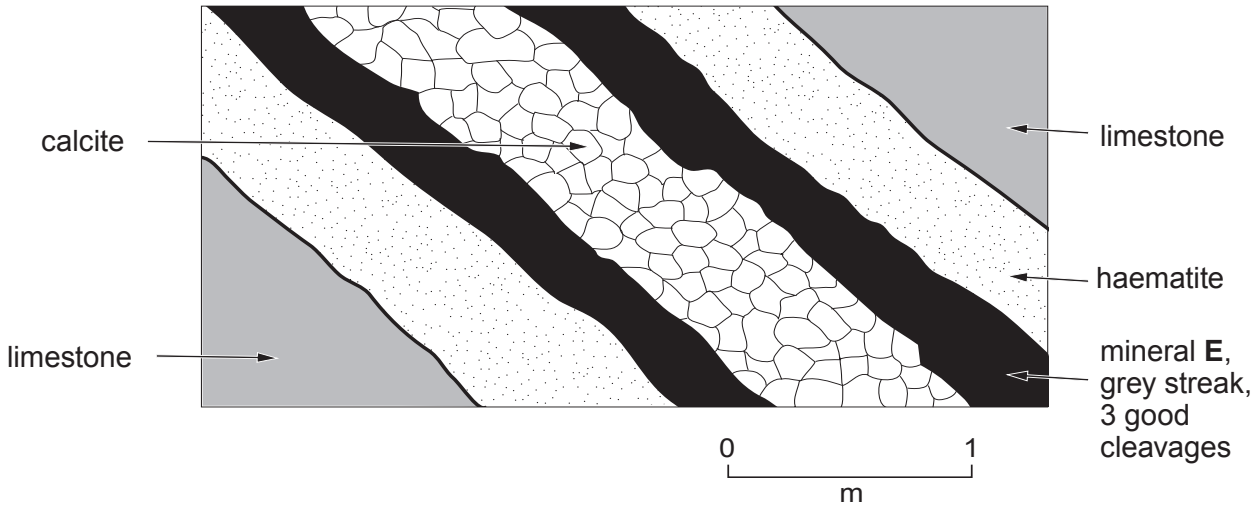

Figure 5b

(a) The mineral vein is 2 metres wide, extends 750 metres along a fault and outcrops at the surface over a distance of 1500 metres. Calculate the total volume of the mineral vein in m^3. [2]

Show your working.

..... m^3

(b) Refer to **Figure 5b** and the Data Sheet.

(i) Name mineral **E**. [1]

.....

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(ii) Complete **Table 5** to show the order in which minerals **E**, calcite and haematite crystallised in the mineral vein. [1]

last to crystallise ↑	
first to crystallise	

Table 5

(c) The mineral vein contains metals in very high concentrations. Describe the processes that are most likely to be responsible for this concentration of metals. [3]

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6. **Figure 6a** shows the depths and temperature conditions under which oil and gas may form.

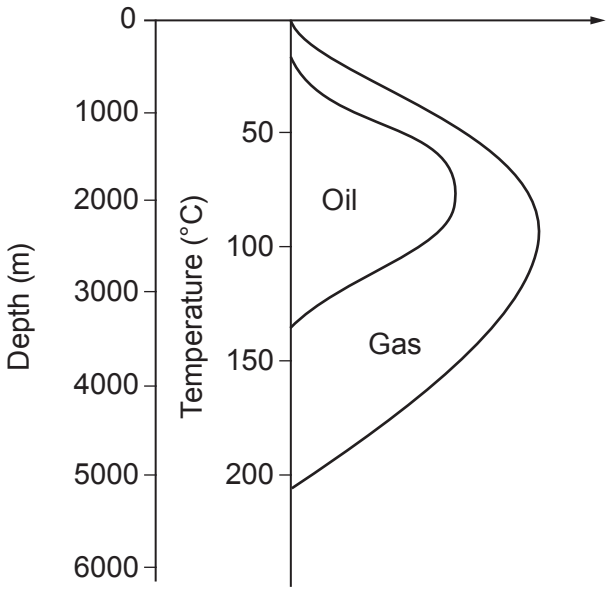

Figure 6a

(a) (i) State which of the following are **correct** with reference to the conditions required for the formation of oil and gas in **Figure 6a**. Tick (✓) only **two** boxes. [2]

oil and gas generally form at the same temperature and depth ☐

the optimum conditions for oil formation are 1900 metres depth and 75°C ☐

oil forms at greater depths and temperatures than gas ☐

oil and gas are not formed deeper than 5100 metres depth and 210°C ☐

gas is not formed until a depth of 1000 metres ☐

oil and gas can form at depths of 4000 metres and temperatures over 150°C ☐

(ii) Calculate the average geothermal gradient in $°Ckm^{-1}$ in the top 5 kilometres of the Earth's crust as shown in **Figure 6a**. Show your working. [2]

..... $°Ckm^{-1}$

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(b) **Figure 6b** shows the texture of a sandstone that is an oil reservoir rock.

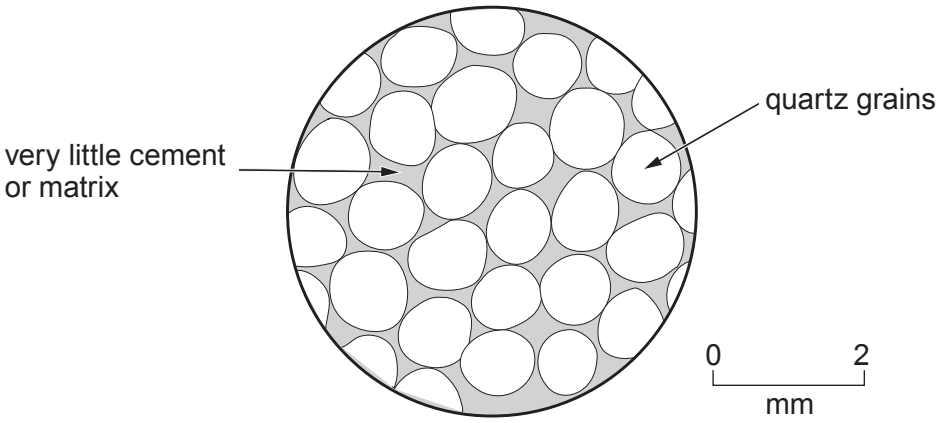

Figure 6b

(i) State the mean grain size of the sandstone shown in **Figure 6b**. Tick (✓) only **one** box. [1]

0.2 mm	☐
0.5 mm	☐
1.0 mm	☐
1.5 mm	☐
2.0 mm	☐

(ii) State which characteristics of the sandstone shown in **Figure 6b** enable it to act as a reservoir rock for oil and gas. Tick (✓) only **one** box. [1]

low porosity and high permeability	☐
high porosity and low permeability	☐
low porosity and low permeability	☐
high porosity and high permeability	☐
well cemented and highly compacted	☐

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(c) **Figure 6c** and **Figure 6d** show geological structures in cross-section that often act as traps for oil and gas.

not to scale

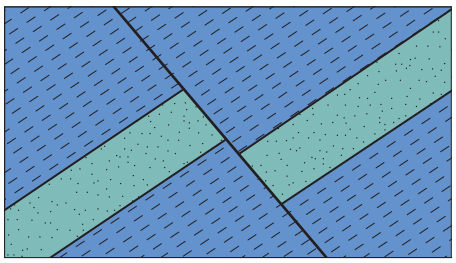

Figure 6c

not to scale

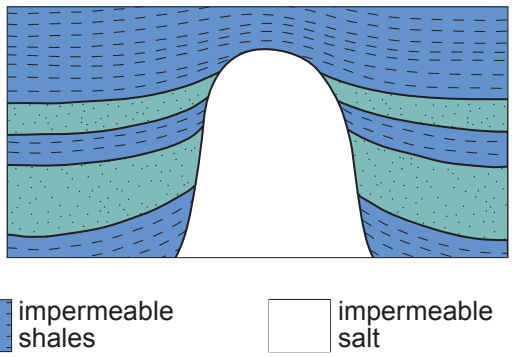

Figure 6d

(i) State the potential types of oil and gas traps shown in **Figure 6c** and **Figure 6d**.
Tick (✓) only **one** box. [1]

anticline and salt dome ☐

fault and unconformity ☐

anticline and fault ☐

fault and salt dome ☐

unconformity and anticline ☐

(ii) State which **two** of the following methods would be suitable in prospecting for oil and gas deposits.
Tick (✓) only **two** boxes. [2]

electron microprobe ☐

borehole correlation using microfossils ☐

scanning electron microscope ☐

seismic survey ☐

river sediment analysis ☐

ground penetrating radar ☐

Examiner only

(iii) Oil and gas deposits can be classified as **reserves** or **resources**. State which **one** of the following best explains the difference between oil and gas reserves and oil and gas resources.
Tick (✓) only **one** box. [1]

reserves occur in much greater quantities than resources	☐
reserves and resources occur in equal measures	☐
resources are the proportion of reserves that can be extracted at a profit	☐
estimation of resources is generally more accurate than the estimation of reserves	☐
reserves are the proportion of resources that can be extracted at a profit	☐

(d) Explain how depleted oil and gas reservoirs might be used in the future to reduce the impact of burning fossil fuels and reduce the rate of climate change. [3]

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END OF PAPER

Acknowledgements:

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Photograph 1b modified from
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Photograph 1c modified from
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Figure 2 modified from
http://www.planet.geo.fu-berlin.de/eng/projects/mars/hrsc566-HadleyCrater.php