FOR OFFICIAL USE

Total

X043/201

NATIONAL QUALIFICATIONS 2011

MONDAY, 16 MAY
1.00 PM – 3.00 PM

GEOLOGY
INTERMEDIATE 2

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Date of birth

Day Month Year

Scottish candidate number

Number of seat

1 You should attempt **all** of the questions.

2 All answers should be written in the spaces provided in this answer book and should be written clearly and legibly in ink.

3 The marks allocated to each question or part of a question are shown at the end of each question or part of a question.

4 Before leaving the examination room you must give this book to the Invigilator. If you do not, you may lose all the marks for this paper.

DO NOT WRITE IN THIS MARGIN

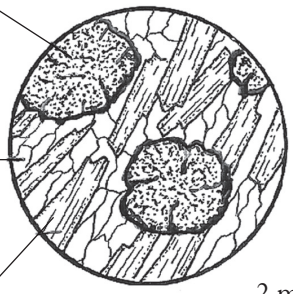
All questions should be attempted.

Marks

1. (*a*) Three of the rocks making up the wall in the diagram below are labelled A, B and C. The minerals contained within each rock are shown in labelled magnified drawings. Some of the properties of these minerals are also given.

Mineral 1
Hardness 6·5 - 7·5
Colour - dark red
No cleavage

Rock A

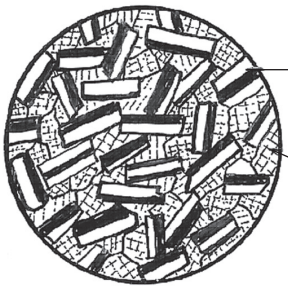


Mineral 2
Hardness 7
Colour - white or clear
No cleavage

Mineral 3
Hardness 2 - 2·5
Colour - white, silvery or clear
One plane of cleavage

2 mm

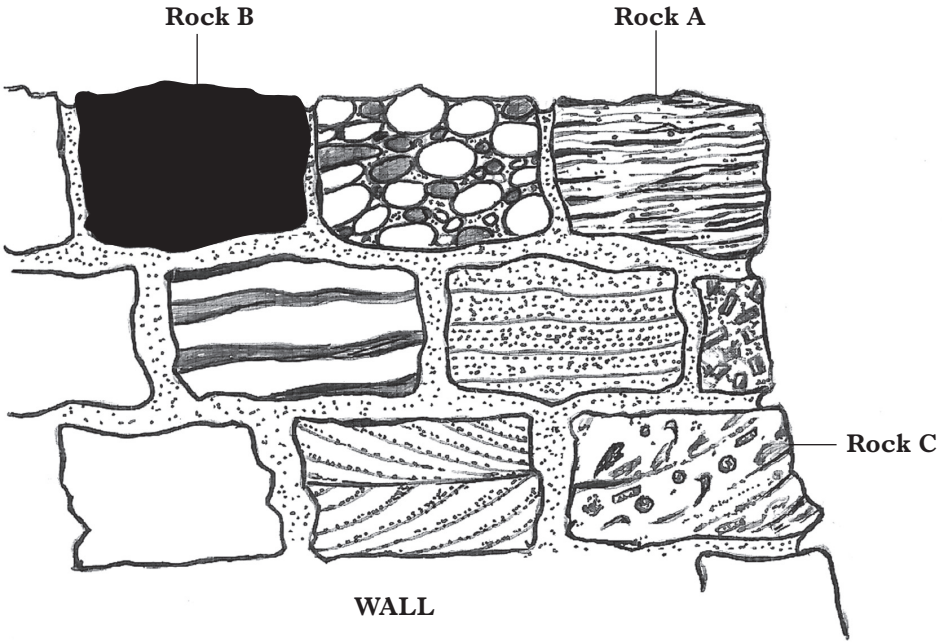
Rock B



Mineral 4
Hardness 6
Colour - white or grey
Two cleavage planes at 90°

Mineral 5
Hardness 5 - 6
Colour - black
Two cleavage planes at 90°

2 mm



WALL

Rock C

2 mm

Mineral 6
Hardness 3
Colour - white or clear
Three planes of cleavage

DO NOT WRITE IN THIS MARGIN

Marks

1. (*a*) (continued)

Complete the table below with the help of the information given on the previous page and the word bank.

Word bank:

amphibole : barite : biotite mica : calcite : cassiterite : feldspar : galena : garnet : gypsum : magnetite : muscovite mica : olivine : pyroxene : quartz : talc: andesite : basalt : limestone : gabbro : granite : greywacke : hornfels : marble : sandstone : slate : schist

Name of mineral	*Name of rock*	*Is the rock igneous, metamorphic or sedimentary?*
1	Rock A:	
2		
3		
4	Rock B:	
5		
6	Rock C:	

8

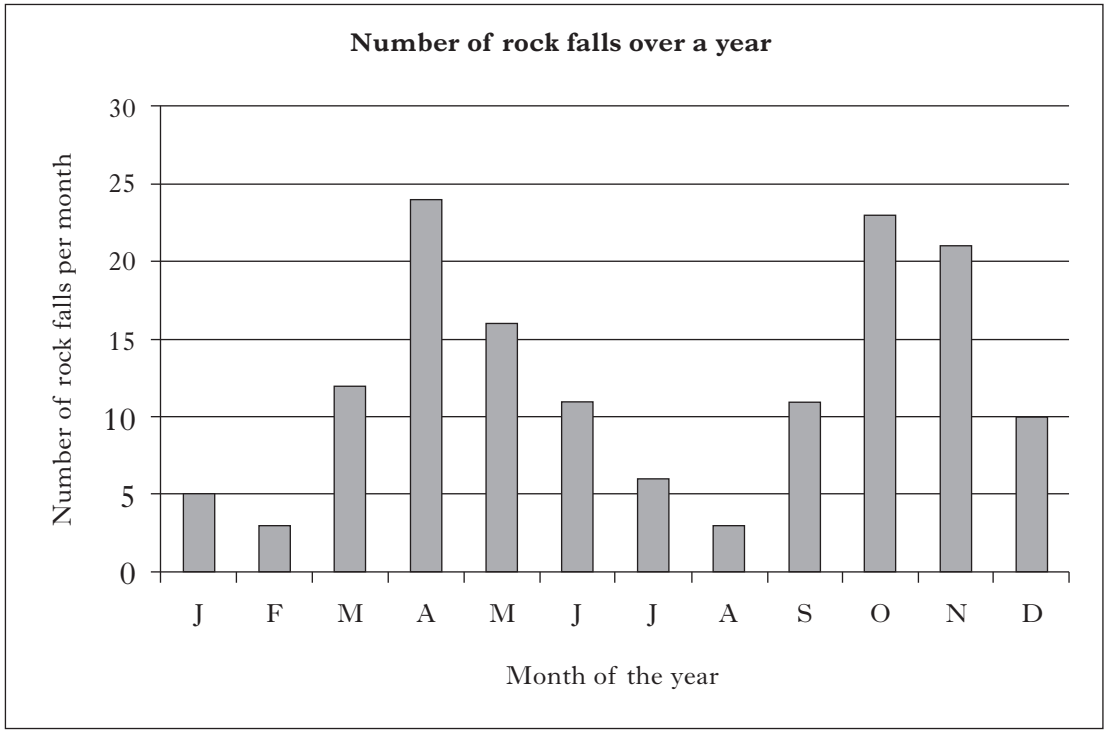
[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

1. (continued)

(*b*) Rocks in upland Norway are prone to frost (freeze/thaw) shattering. The graph below shows the frequency of rock falls every month over a year in an area of upland Norway.



(i) Describe the change in the number of rock falls over the year.

.....

.....

..... **1**

(ii) Explain why the frequency of the rock falls varies with the seasons in this part of Norway.

.....

.....

.....

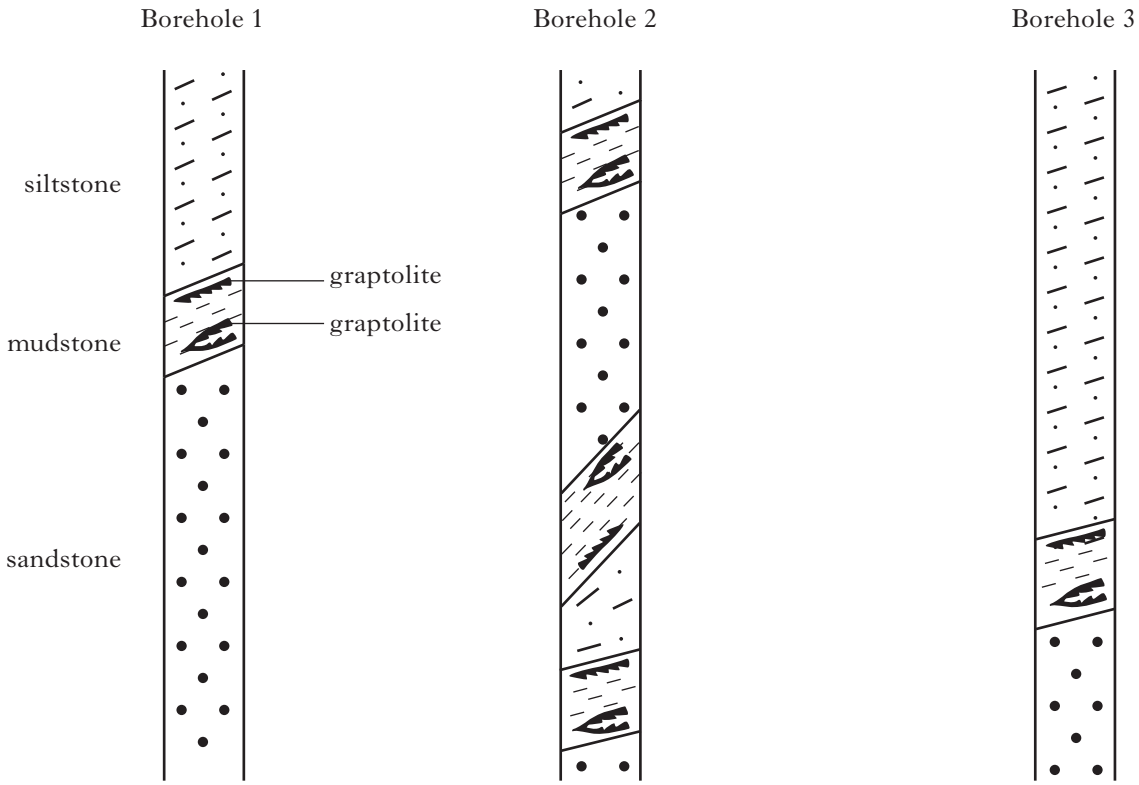
..... **2**

[Turn over for Question 2 on *Page six*

DO NOT WRITE IN THIS MARGIN

Marks

2. The diagram below shows rocks found in boreholes sunk into folded rocks.



(*a*) Complete the diagram to show the folds. **1**

(*b*) How can you tell that the rocks are sometimes upside down?

.....

..... **1**

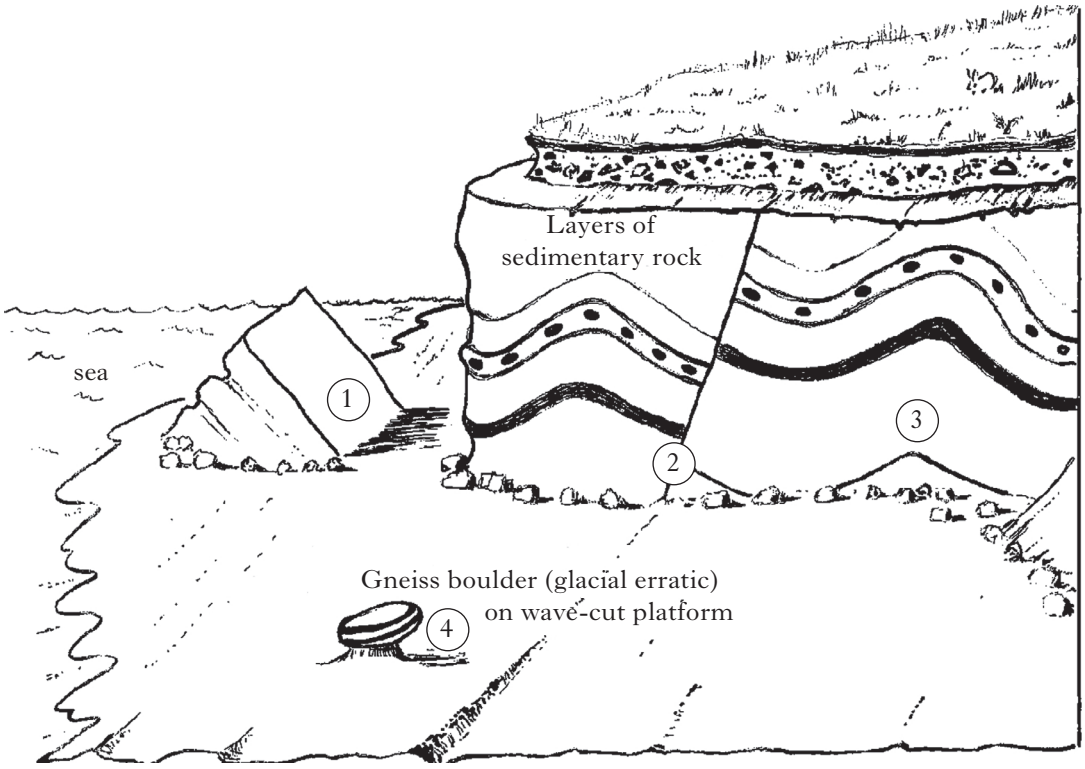
(*c*) Name the oldest rock in the diagram.

..... **1**

Marks

2. (continued)

(*d*) The sketch below shows a headland at low tide. The area was visited by a group of geology students in the month of February. They decided to carry out typical fieldwork measurements at positions 1 to 4.



(i) State **one** measurement that could be taken at each location. Give a different measurement for each location.

Position	*Measurement*
1	
2	
3	
4	

2

(ii) Describe **four** safety precautions that should be taken whilst carrying out fieldwork in this area.

1 .....

2 .....

3 .....

4 ..... **2**

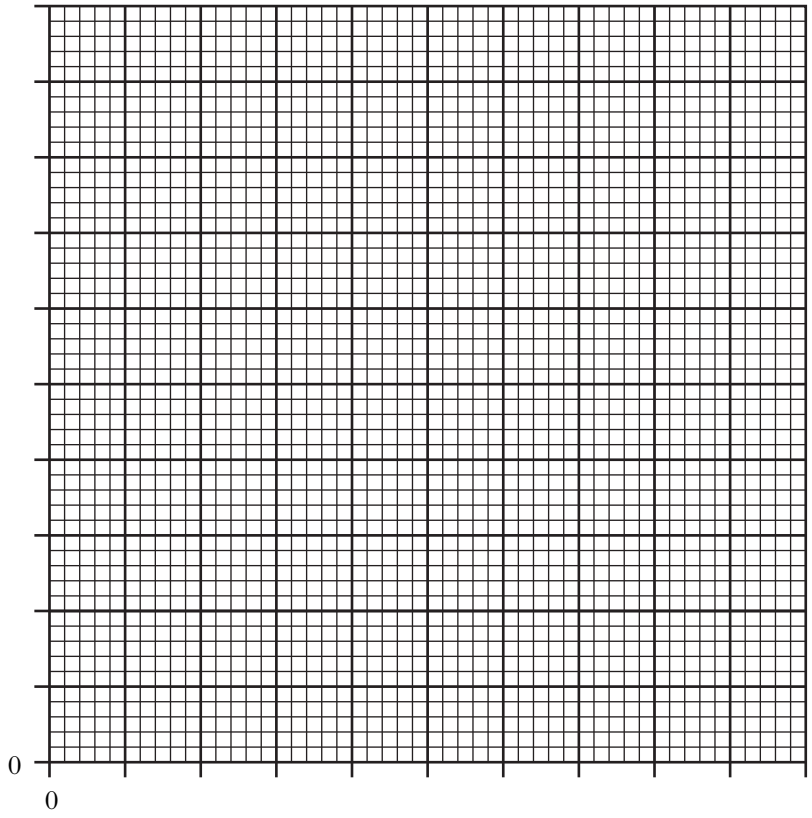
DO NOT WRITE IN THIS MARGIN

Marks

3. The table below shows the water content of lavas of different ages that came from one volcano.

Age of lava (millions of years)	*Water content* (% by weight)
1	1·45
2	1·15
3	0·87
4	0·57
5	0·30

(*a*) On the graph paper provided, draw a line graph of age of lava against water content.



3

(*b*) Describe the general relationship shown by the graph.

.....

..... **1**

DO NOT WRITE IN THIS MARGIN

Marks

3. (continued)

(*c*) Predict the percentage water content in lava erupted very recently.

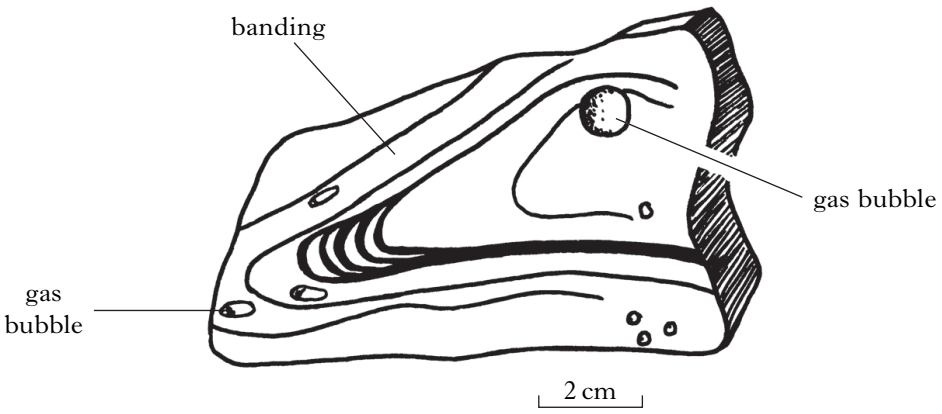
..... % **1**

(*d*) How many times greater is the percentage of water in the 1 million year old lava than the 4 million year old lava?

Space for calculation—give your answer correct to 2 decimal places.

..... times **2**

(*e*) The diagram below shows a specimen of lava.



What name is given to gas bubbles trapped within lava?

..... **1**

(*f*) Explain why banding forms in some lavas.

.....

.....

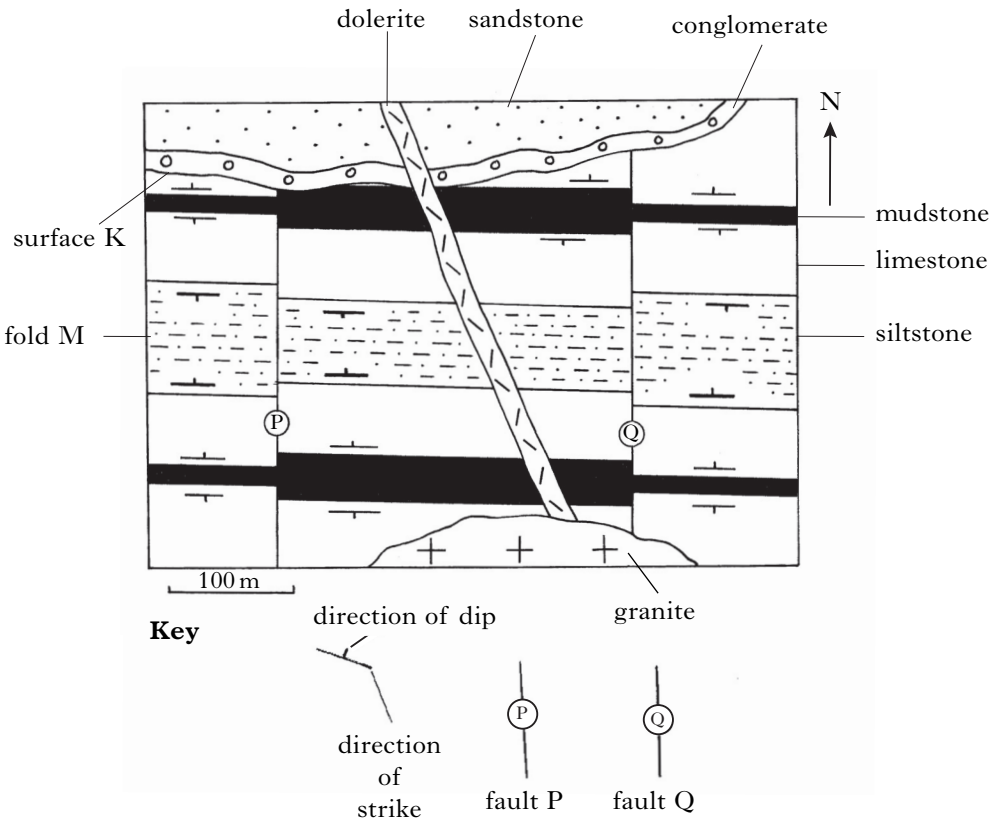
..... **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

4. Study the geological map below.



(*a*) (i) What type of structure is surface K?

..... **1**

(ii) How has surface K formed?

.....

..... **1**

(*b*) What type of intrusion is formed by the dolerite?

..... **1**

(*c*) What type of fold is M?

..... **1**

(*d*) (i) Name the oldest sedimentary rock on the map.

..... **1**

(ii) Name the youngest sedimentary rock on the map.

..... **1**

DO NOT WRITE IN THIS MARGIN

Marks

4. (continued)

(*e*) On which side of fault P have the rocks been moved up? Give a reason for your answer.

Side of fault P: **1**

Reason: .....

.....

..... **1**

(*f*) Place the following events in the correct order from oldest to youngest.

A Folding of rocks

B Intrusion of dolerite

C Deposition of siltstone

D Movement on fault P

E Intrusion of granite

F Formation of surface K

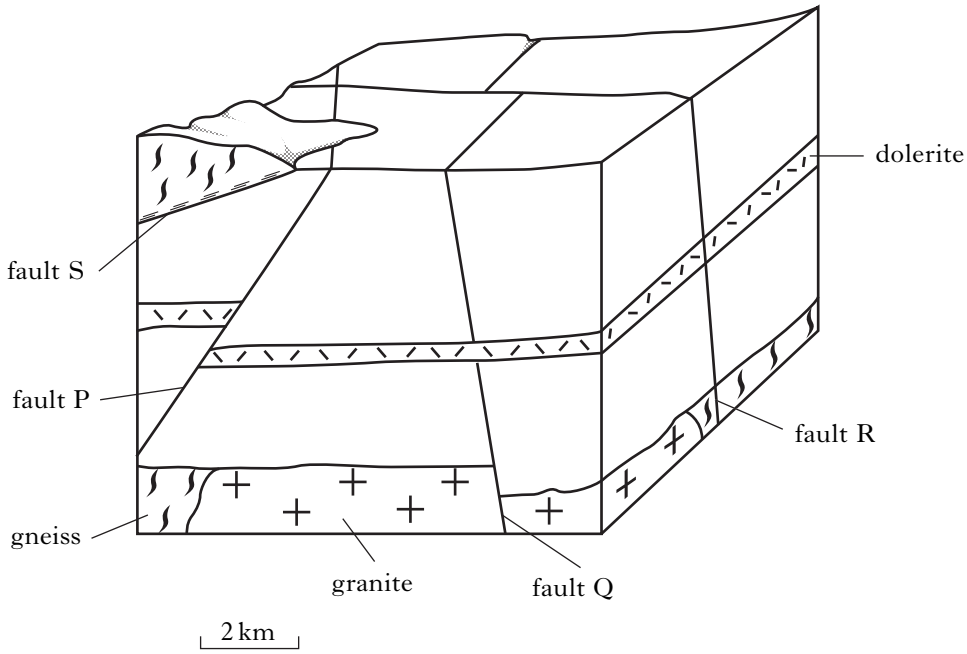
Give only the letters: ..... → ..... → ..... → ..... → ..... → **3**
oldest youngest

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

5. Study the block diagram below.



(*a*) What types of fault are P, Q, R and S?

Fault P: ..... Fault Q: .....

Fault R: ..... Fault S: **3**

(*b*) Name the metamorphic rock that has formed along fault S?

..... **1**

(*c*) Which **two** of the following statements are correct?

A Slate is formed from metamorphosed sandstone.

B Metamorphic rocks can be metamorphosed again.

C Metamorphic rocks are all formed from igneous rocks.

D Metaquartzite consists mainly of calcite.

E Schist usually forms when gneiss melts.

F Mudstones can be turned into hornfels as a result of thermal metamorphism.

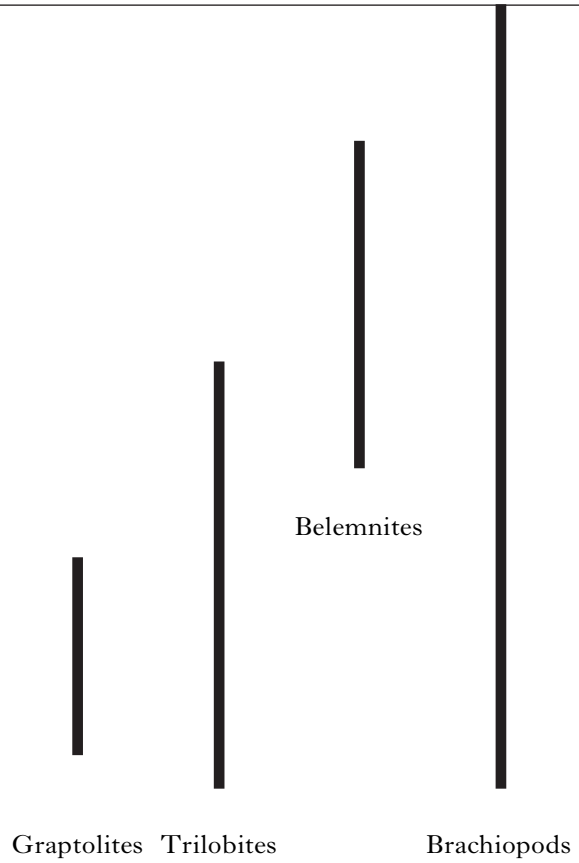
Give only the letters: ..... and **2**

DO NOT WRITE IN THIS MARGIN

Marks

6. The table below shows the geological history of four fossil groups.

Eras/Periods since the formation of the Earth	*Duration (Millions of Years)*	*Time span line of four fossil groups*
Quaternary	2	
Tertiary	65	
Cretaceous	80	
Jurassic	65	
Triassic	35	
Permian	45	
Carboniferous	70	
Devonian	50	
Silurian	30	
Ordovician	70	
Cambrian	60	
Precambrian	4000	



(*a*) Which fossil on the time diagram would allow rocks to be most accurately dated? Give a reason for your answer?

Fossil: **1**

Reason: .....

..... **1**

(*b*) A rock was found to contain trilobites, belemnites and brachiopods. Name a geological period in which it could have formed.

..... **1**

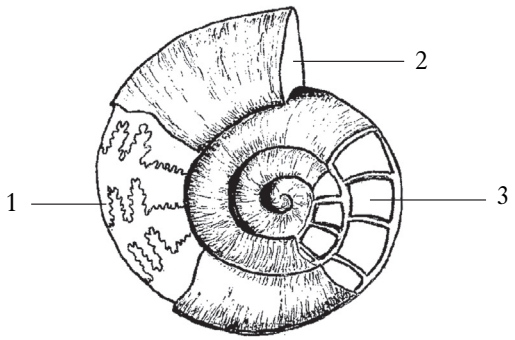
[Turn over

DO NOT WRITE IN THIS MARGIN

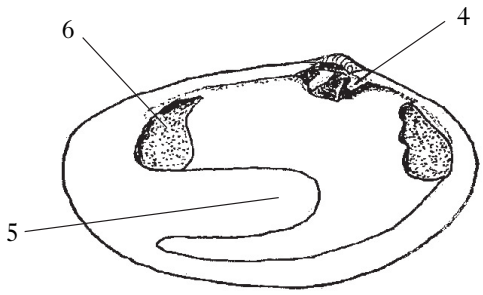
Marks

7. (*a*) (i) In the table below, name the parts numbered 1 to 6 of the fossils A and B.

Fossil A



Fossil B—inside view of a valve



Fossil B—exterior view of valves

Number	*Name*
1	
2	
3	
4	
5	
6	

3

(ii) Name fossils A and B.

Name of fossil A: .....

Name of fossil B: **1**

DO NOT WRITE IN THIS MARGIN

Marks

7. (continued)

(*b*) Explain why fossil A is often found as a complete fossil in many types of sediment.

.....

.....

..... **1**

(*c*) Draw a line through fossil B to show its plane of symmetry. **1**

(*d*) From the sketches of fossil B, suggest where it lived. Give a reason for your answer.

Where it lived: .....

..... **1**

Reason: .....

.....

..... **1**

(*e*) Indicate which of the following are trace fossils. Place a tick (✓) opposite a correct option.

Type of fossil	*If a trace fossil add a tick* (✓)
Dinosaur footprint	
Hair of a woolly mammoth	
Test of echinoid	
Bite marks of a predator fish on a smaller fish	
Grazing trail of a trilobite	
Burrow of a piddock (a rock boring bivalve)	
Brachiopod pedicle valve	
Belemnite guard	

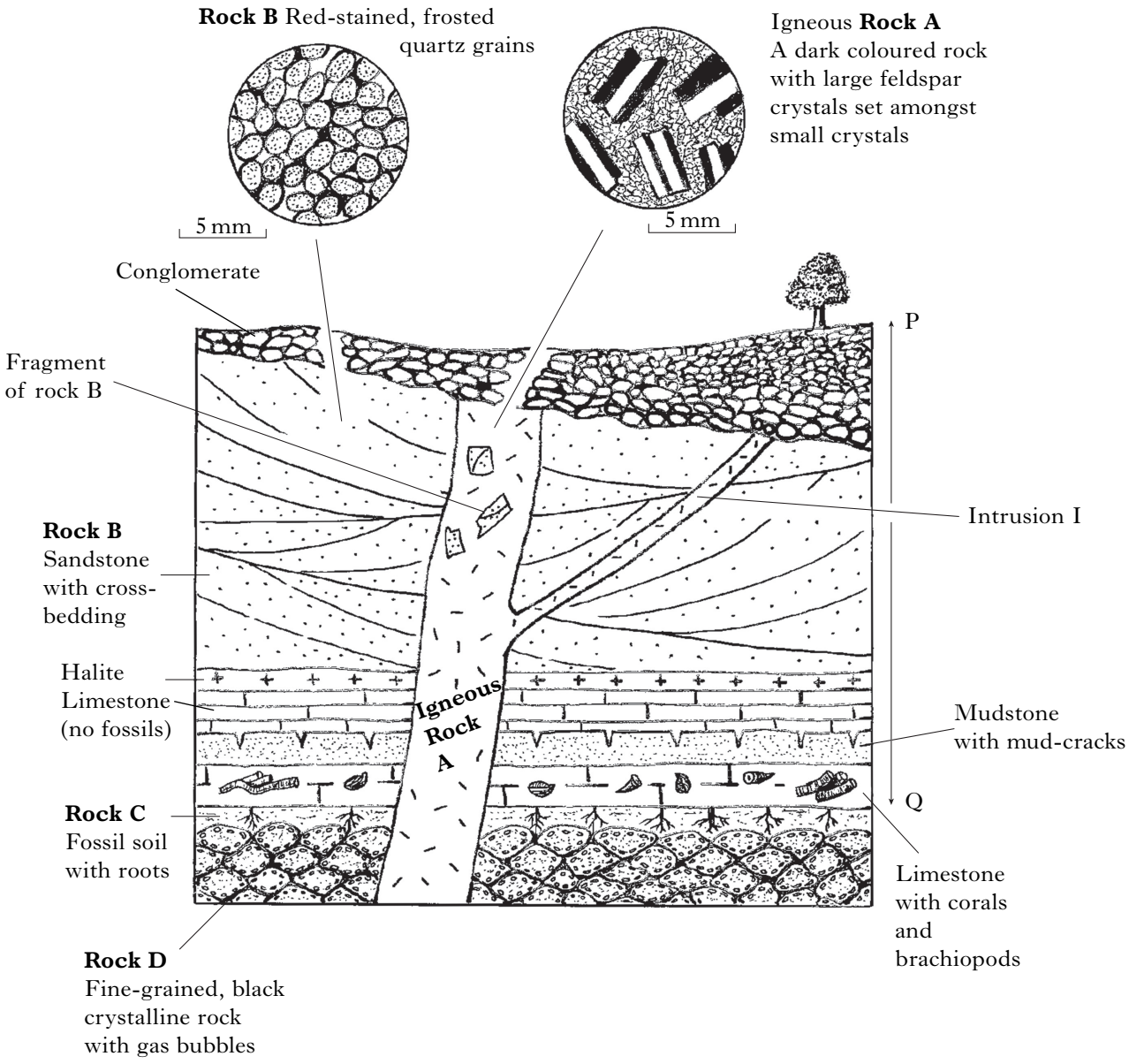
2

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

8. The diagram below shows a section through a quarry and magnified drawings of rock A and rock B.



(*a*) Describe the processes involved in forming igneous rock A.

.....

.....

.....

..... **1**

DO NOT WRITE IN THIS MARGIN

Marks

8. (continued)

(*b*) (i) Igneous rock A contains fragments of rock B. What name is given to a fragment of another rock found within an igneous rock?

A Xenolith

B Phenocryst

C Concretion

D Amygdale

Give only the letter: **1**

(ii) Account for the red colour in rock B (sandstone).

.....

..... **1**

(iii) Account for the shape of the quartz grains in rock B (sandstone).

.....

..... **1**

(*c*) (i) Intrusion I is 100 cm wide. The table below gives the average size of crystals from one side of the intrusion to the other.

Distance from one side of the intrusion to the other (cm)	*Crystal size* (mm)
2	0·20
30	1·25
38	2·00
45	2·50
52	3·00
62	2·20
78	1·00
94	0·40

Describe the general relationship shown in the table between crystal size and distance from the sides of the intrusion.

.....

..... **1**

DO NOT WRITE IN THIS MARGIN

Marks

8. (*c*) (continued)

(ii) Explain why crystal size changes across the width of intrusion I.

.....

.....

..... **2**

(*d*) Give **two** reasons for identifying rock D as a lava flow and not a sill.

Reason 1: .....

.....

Reason 2: .....

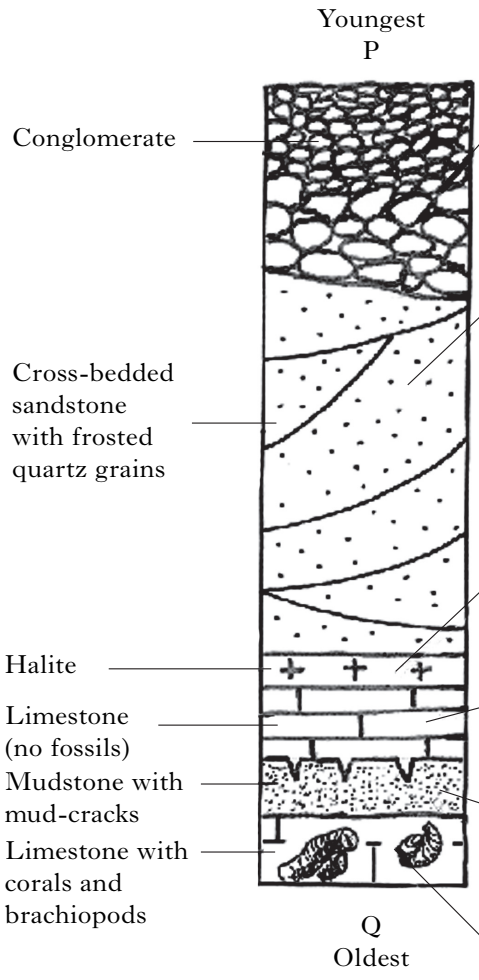
..... **2**

DO NOT WRITE IN THIS MARGIN

Marks

8. (continued)

(*e*) The diagram shows rocks seen in a section of the quarry between P and Q. Describe the geological events and environment of deposition of the rocks and structures seen in this part of the quarry by completing the boxes below. One box has been completed for you.



Sea invades a land area. The climate becomes drier and limestone precipitates from solution as water evaporates.

5

[Turn over

DO NOT WRITE IN THIS MARGIN

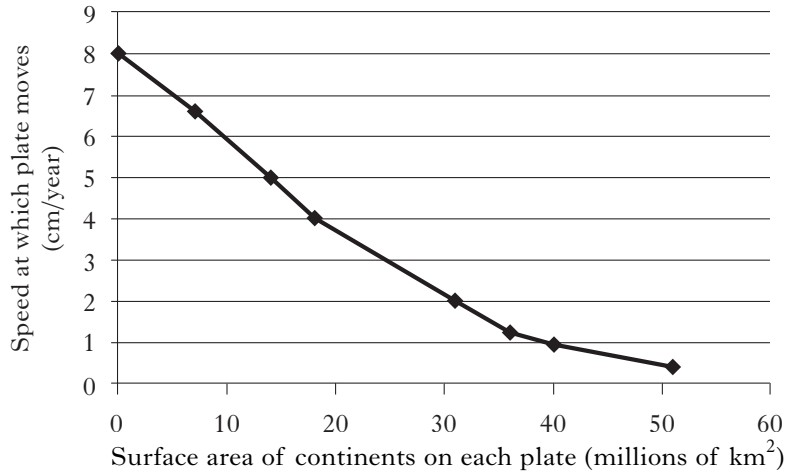
Marks

9. Research was carried out into the speed of movement of the eight largest plates on the Earth's surface. The aim was to discover if there was a relationship between rate of movement of the plates, and:

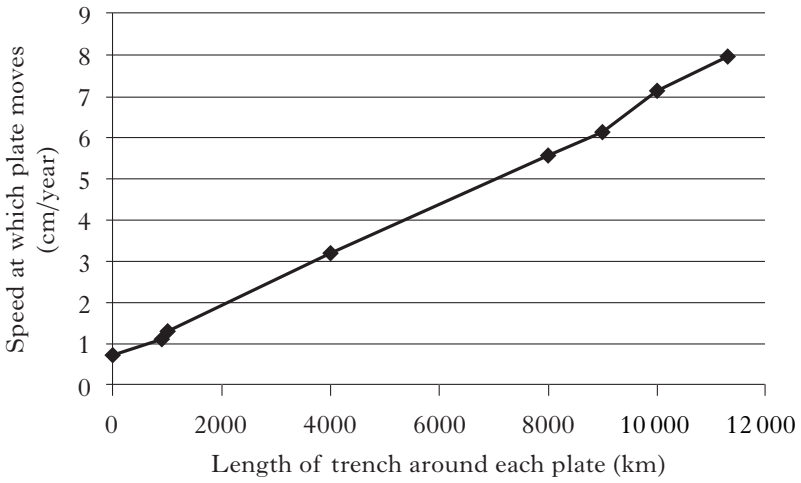
- the surface area of the continents on each plate;
- the length of trench around each plate.

The results are shown in graphs 1 and 2.

Graph 1: Surface area of continents on each plate plotted against speed at which each plate moves.



Graph 2: Length of trenches around each plate plotted against the speed at which each plate moves.



The table gives more detailed information about four of the plates.

Name of plate	*Surface area of continents on the plate* (millions of km^2)	*Length of trench around each plate* (km)
Pacific	0	11 300
North American	36	1000
Eurasian	51	0
African	31	900

DO NOT WRITE IN THIS MARGIN

Marks

9. (continued)

(*a*) Using the information in the graphs and table, decide which plate is moving fastest. Give **two** reasons for your answer.

Plate moving fastest: **1**

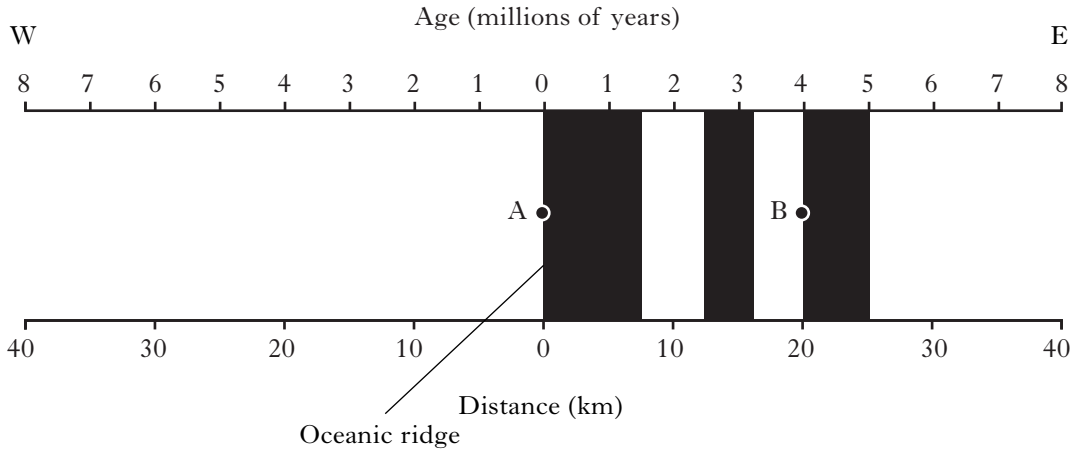
Reason 1: .....

.....

Reason 2: .....

..... **2**

(*b*) The diagram shows a set of magnetic stripes in an area of oceanic crust east of an oceanic ridge.



(i) Calculate the rate of sea floor spreading between A and B in centimetres per year.

Space for calculation

Answer ..... cm/year **1**

(ii) Complete the diagram to the west of the oceanic ridge to show the magnetic stripes. **1**

(iii) Add **two** arrows to the diagram to show the directions of plate movements. **1**

(iv) Name the type of plate boundary shown in the diagram.

..... **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

10. The porosity of a sediment is the percentage of pore space between the sediment fragments.

The table gives:

- the porosity of some sediments as they would have been as **they formed as surface deposits**
- the thickness of these deposits **before** and **after** they have been compacted due to other sediments being deposited on them.

Note: a sediment in which all the particles have a similar size is referred to as "well-sorted".

Sediment	*Porosity of surface deposits* (% pore space)	*Thickness when deposited* (m)	*Thickness after burial* (m)
Well-sorted gravel	30	10	9
Well-sorted sand	39	10	8
Mixed sand and gravel	25	10	8·5
Well-sorted silt	52	10	5
Well-sorted clay	55	10	2
Glacial deposits	13	10	9

(*a*) Explain why the mixed sand and gravel has a lower porosity than the well-sorted gravel and the well-sorted sand.

.....

..... **1**

(*b*) Which sediment has been compacted the most after burial?

..... **1**

(*c*) Express as a simple whole number ratio the porosities of well-sorted sand to well-sorted silt to glacial deposits.

Space for calculation

Well-sorted sand: ..... Well-sorted silt: ..... Glacial deposits: **1**

Marks

10. (continued)

(*d*) Which **one** of the following three sediments will have the greatest porosity and therefore be the best reservoir for oil and gas after burial? Assume that no cementation occurs.

Well-sorted sand

Well-sorted silt

Glacial deposits

Note: calculations must be shown to obtain full marks.

Space for calculations

Sediment: **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

11. (*a*) What is the epicentre of an earthquake?

.....

..... **1**

(*b*) Give the order in which the three types of seismic wave from an earthquake arrive at a seismometer.

1st ..... 2nd ..... 3rd **1**

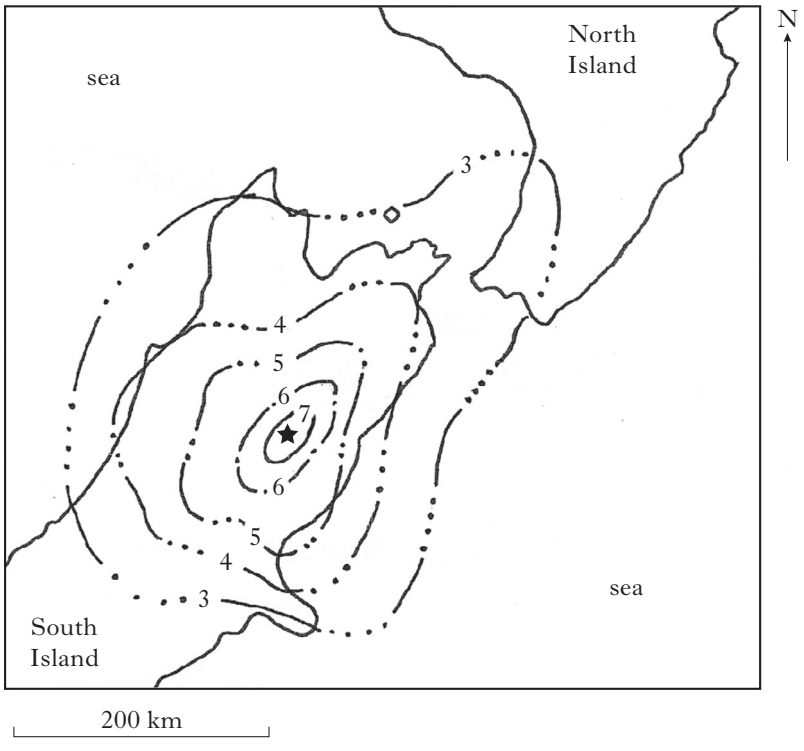
(*c*) What is the intensity of an earthquake?

.....

.....

..... **1**

(*d*) The map shows lines of equal intensity surrounding the epicentre of an earthquake that took place in New Zealand.



Key ★ epicentre of earthquake

5 line joining points of equal earthquake intensity

DO NOT WRITE IN THIS MARGIN

Marks

11. (*d*) (continued)

Which **one** of the following statements is correct?

A Earthquake intensity decreases at an equal rate in all directions from the epicentre.

B Earthquake intensity decreases more rapidly towards the north east than towards the east.

C At the epicentre, earthquake intensity is greater than 7.

D Earthquake intensity depends only on distance from the epicentre.

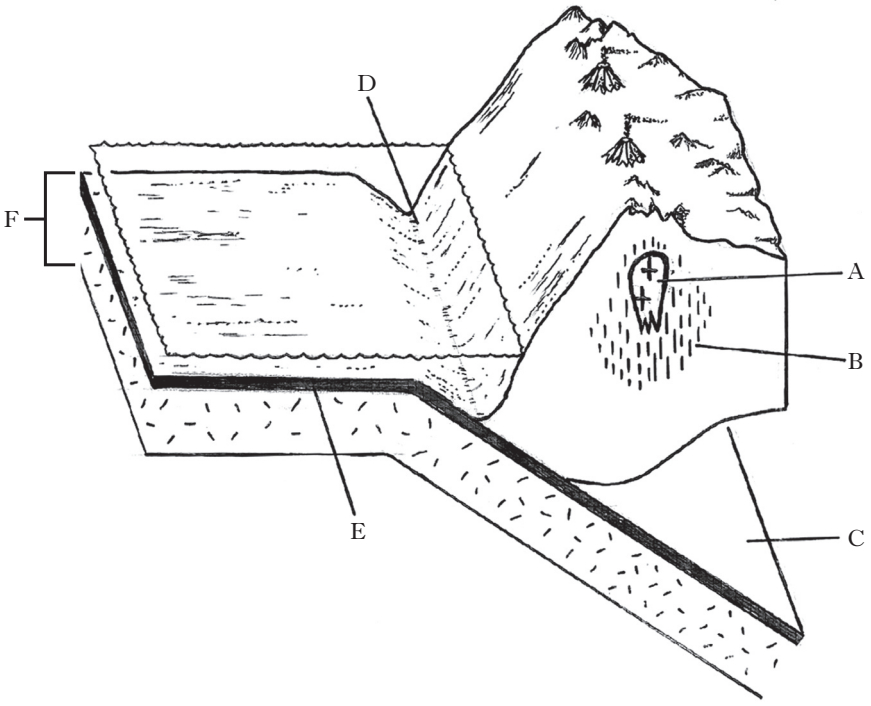
Give only the letter: **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

12. Study the diagram below.



(*a*) Complete the table by naming features A to F. Use six names from the following list.

Asthenosphere
Gabbro intrusion
Granite batholith
Lithosphere
Oceanic crust
Oceanic trench
Site of regional metamorphism
Site of deep focus earthquakes
Site of shallow focus earthquakes

Letter on diagram	*Name of feature*
A	
B	
C	
D	
E	
F	

3

(*b*) Name the type of plate margin shown in the diagram.

.....

1

(*c*) Which type of lava typically erupts from the volcanoes shown in the diagram?

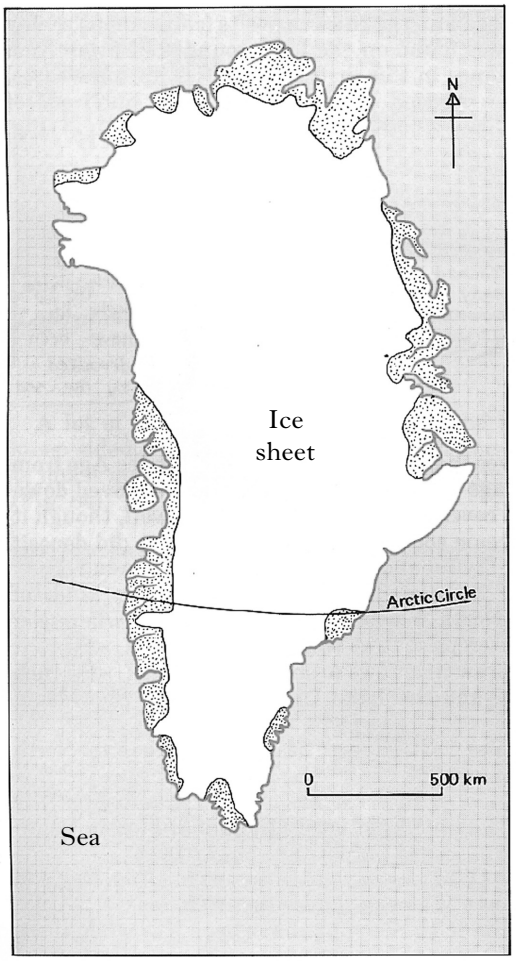
.....

1

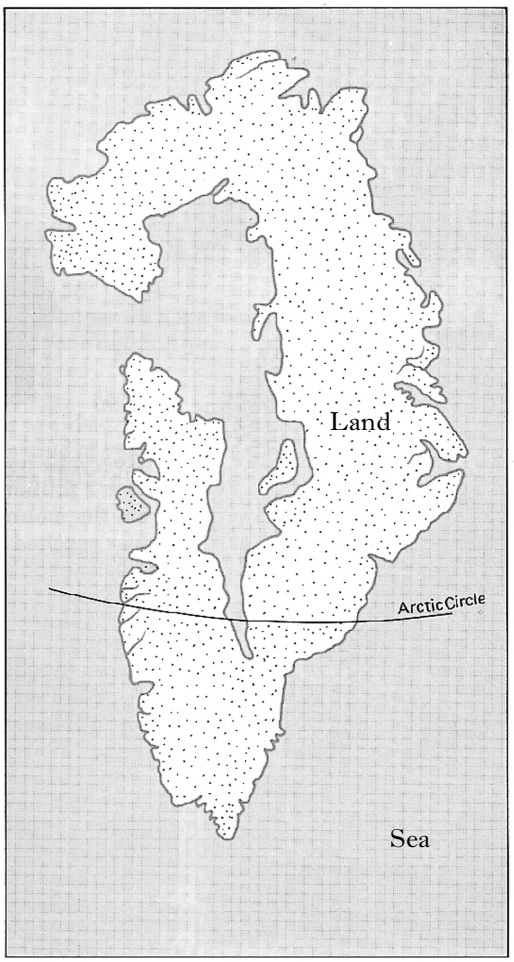
Marks

13. Map 1 shows Greenland as it is today. It is mostly covered by a large ice sheet. Map 2 is an imaginary map of Greenland showing the coastline after all ice has been removed but sea level kept at today's position.

Map 1



Map 2



Map 2 does not take into account two consequences that would result from a worldwide ice melt.

(*a*) What will be the **two** consequences of the worldwide ice melt on Greenland over the next 10 000 years?

1 .....

2 ..... **2**

(*b*) On map 2 draw in **two** possible coastlines. One for 100 years after the worldwide ice melt (and labelled 100) and the other for 10 000 years after the melt (labelled 10 000). **1**

[*END OF QUESTION PAPER*]

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