FOR OFFICIAL USE

Total

X043/11/01

NATIONAL QUALIFICATIONS 2013

TUESDAY, 7 MAY
9.00 AM – 11.00 AM

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.

All questions should be attempted.

Marks

1. (*a*) Complete the key to minerals given below. Use eight items from the word bank.

barite : cassiterite : fluorite : galena : garnet : gypsum : magnetite : malachite : pyrite : talc

Minerals

Mineral forms brassy yellow cubes

Name: .....

Mineral does not form brassy yellow cubes

Can be scratched by fingernail

Hardness 1
soapy feel

Name: .....

Hardness 2
Some forms look like satin or silk

Name: .....

Cannot be scratched by fingernail

Is a source of metal

Source of copper
bright green colour

Name: .....

Source of iron
black colour
black streak

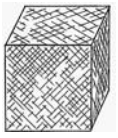
Name: .....

Source of tin
black shiny crystals
brown streak

Name: .....

Not a source of metal

Variable colour
hardness 4
4 planes of cleavage



Name: .....

Red brown colour
hardness 7·5
no cleavage

Name: .....

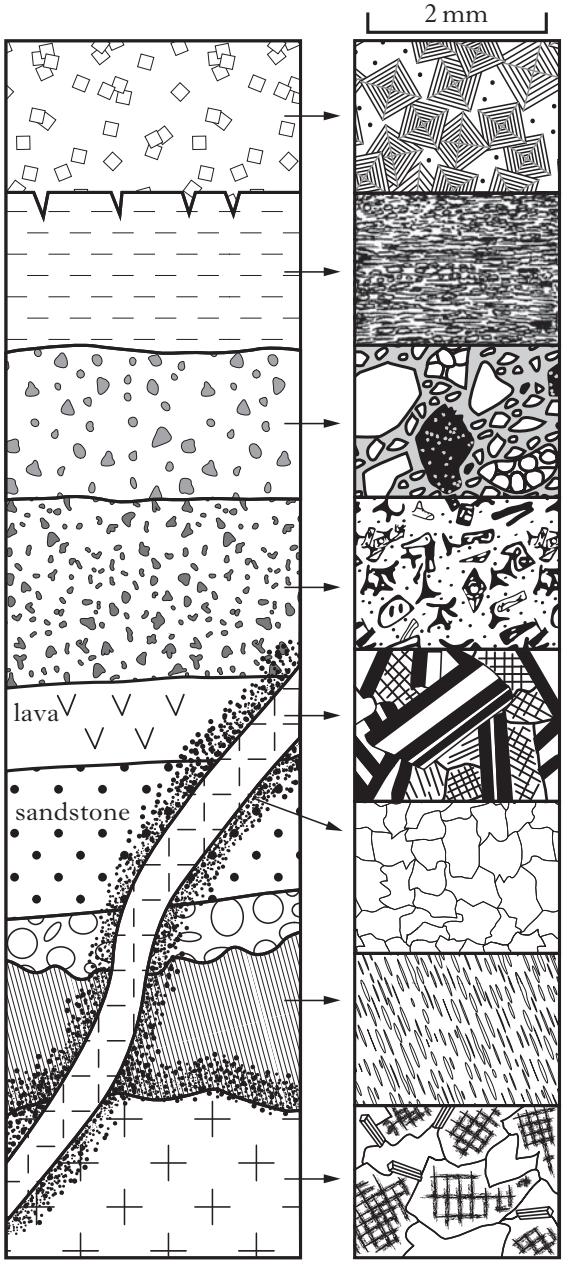
4

Marks

1. (continued)

(*b*) Complete the table below by naming the rocks found in the borehole. Use names from the following list.

dolerite : gabbro : granite : greywacke : hornfels : limestone : quartzite : rock salt : shale : slate : tuff

Drawing to show rocks in borehole	*Drawing of rock*	*Description of rock and main minerals/materials present*	*Name of rock*
		Formed by the evaporation of seawater. Halite.	
		Very fine grained sedimentary rock. Quartz, clay and muscovite mica.	
		Type of sandstone made up of quartz and rock fragments in a muddy material.	
		Formed from material thrown into the air during a volcanic eruption. Broken igneous rock, glass fragments.	
		Medium-grained igneous rock formed by a moderate rate of cooling. Pyroxene and feldspar.	
		Formed by the thermal metamorphism of sandstone. Quartz	
		Fine-grained rock formed by regional metamorphism. Quartz and muscovite mica.	
		Coarse-grained igneous rock formed by very slow cooling. Quartz, feldspar and mica.	

4

DO NOT WRITE IN THIS MARGIN

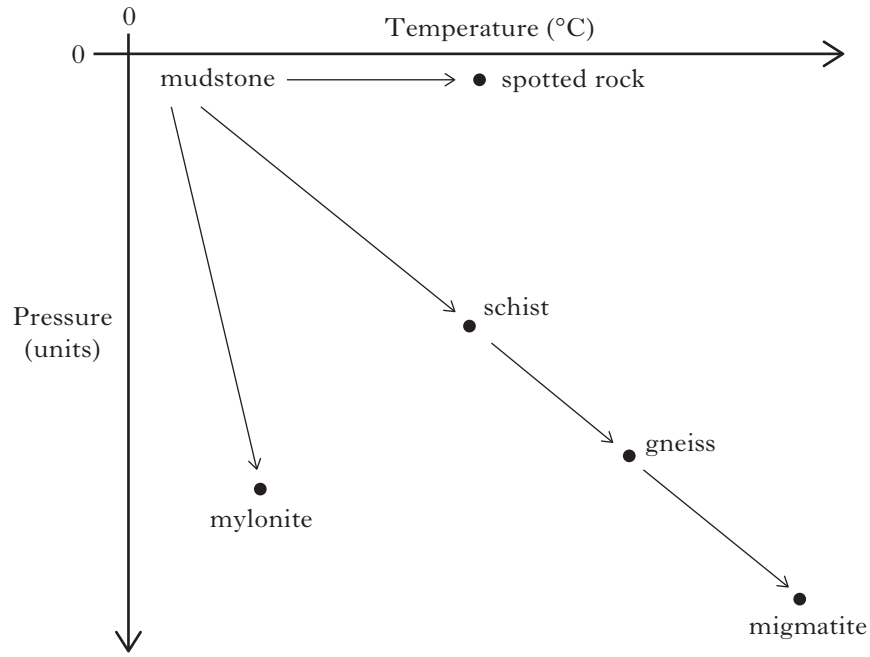
Marks

1. (continued)

(*c*) The graph below shows rocks formed by the metamorphism of mudstone as temperature and pressure change.

Some of the features of the metamorphic rocks named on the graph are listed in the table below. Match the names of the rocks with the correct feature.

You may use a name once, more than once, or not at all.



Feature	*Name of metamorphic rock*
Has been formed by **thermal** metamorphism	
Shows signs of partial melting and banding	
Shows banding only	
May contain index minerals such as garnet, biotite or chlorite	
Its minerals are not lined up in any particular direction	
Is formed at the lowest temperature	

3

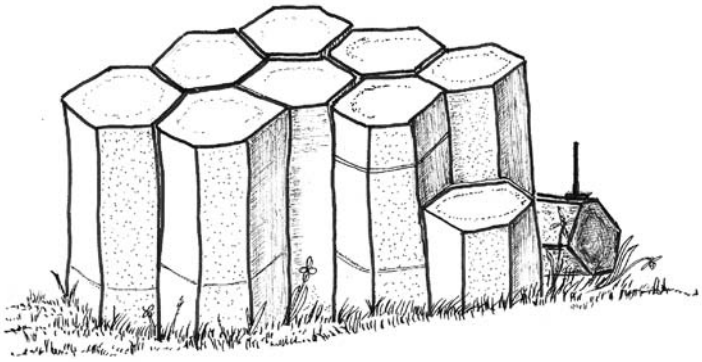
DO NOT WRITE IN THIS MARGIN

Marks

2. Drawings of two rock structures labelled A and B are shown below.

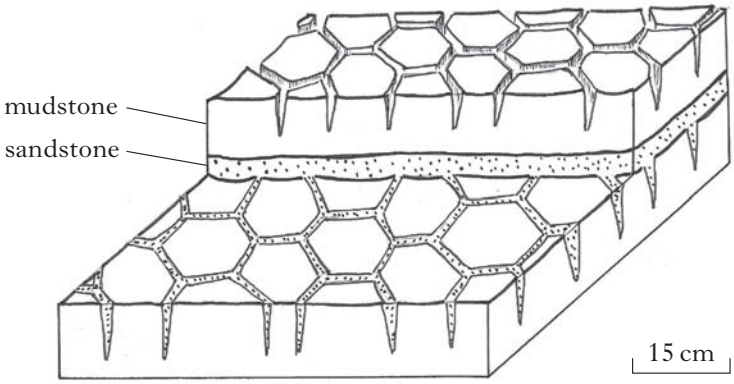
(*a*) Name rock structures A and B.

A



Name: .....

B



Name: **2**

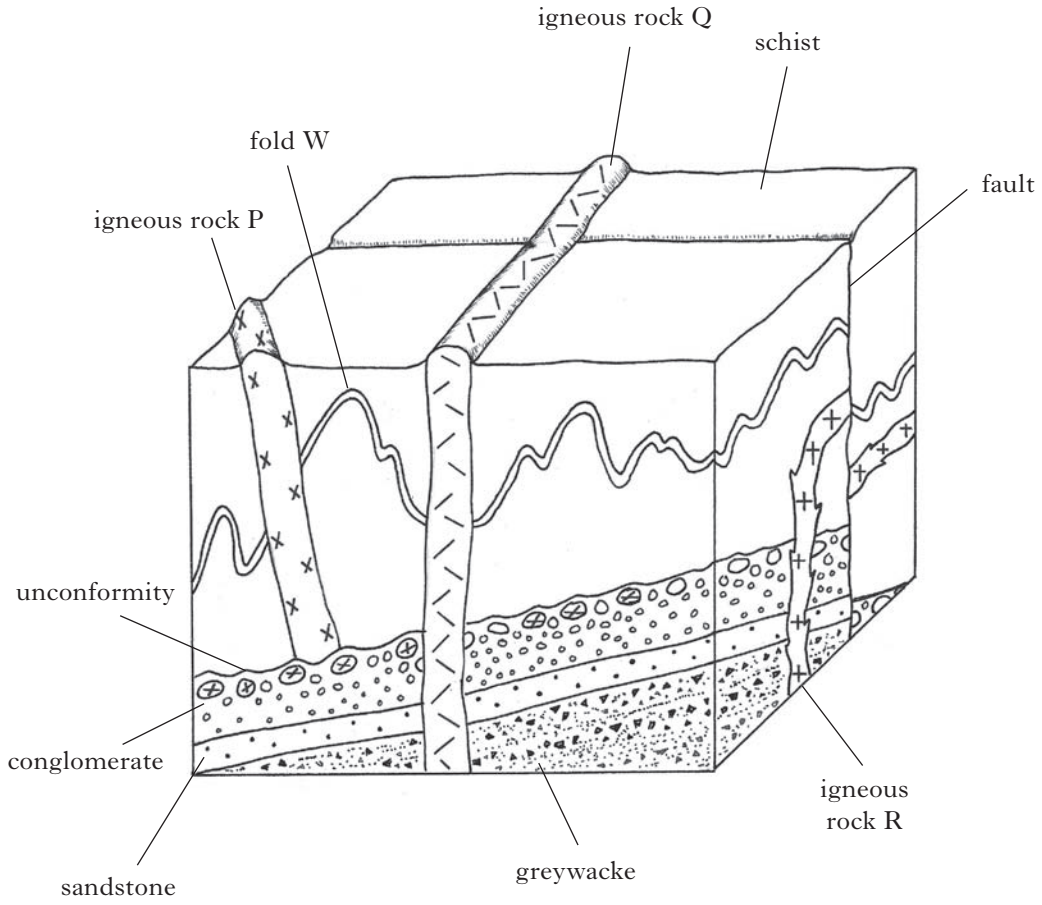
(*b*) Explain how structure A was formed.

3

DO NOT WRITE IN THIS MARGIN

Marks

3. Study the block diagram below.



(*a*) The rocks have been turned upside down. Give **two** pieces of evidence to indicate that this is true.

1 .....

.....

2 .....

..... **2**

(*b*) Underline the correct alternatives in the sentence below.

Fold W was produced by **pulling**/**pushing** forces and is a/an **anticline**/**syncline** that has been turned upside down. **1**

DO NOT WRITE IN THIS MARGIN

Marks

3. (continued)

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

A Movement on fault

B Formation of schist

C Intrusion of igneous rock R

D Intrusion of igneous rock P

E Intrusion of igneous rock Q

F Deposition of conglomerate

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

[Turn over

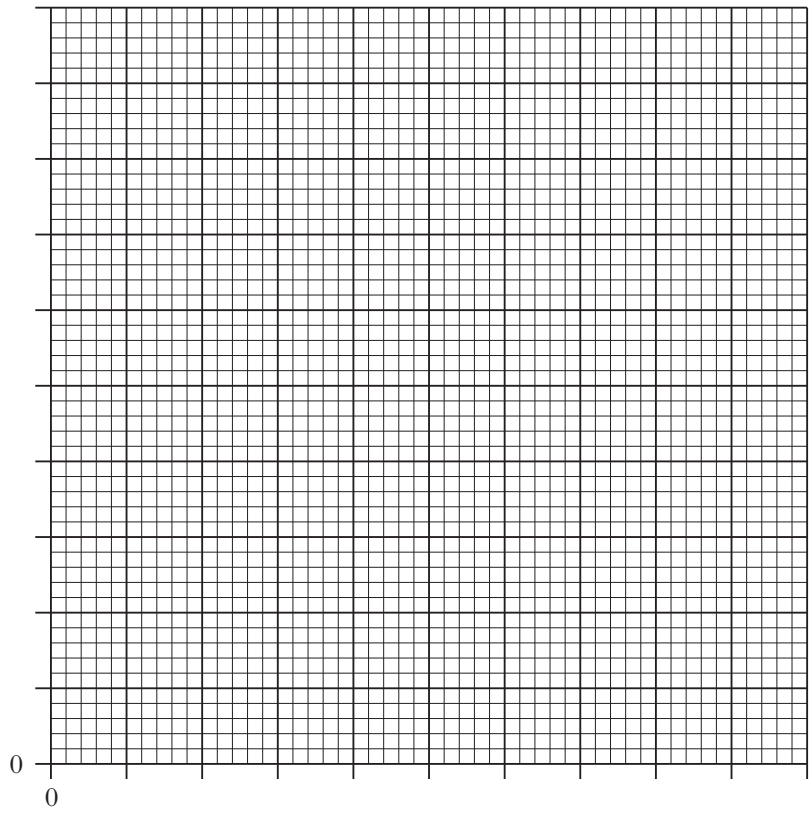
DO NOT WRITE IN THIS MARGIN

Marks

4. The temperature of mudstone around a granite batholith was recorded at varying distances from the intrusion. The results are given in the table below.

Distance from the edge of the batholith (m)	*Temperature of mudstone* (°C)
0	740
100	600
200	490
300	400
400	330
500	300
600	290
700	280
800	280
900	280

(*a*) On the graph paper provided, draw a line graph of distance from the edge of the batholith against the temperature of the mudstone.



3

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

.....

.....

..... **2**

DO NOT WRITE IN THIS MARGIN

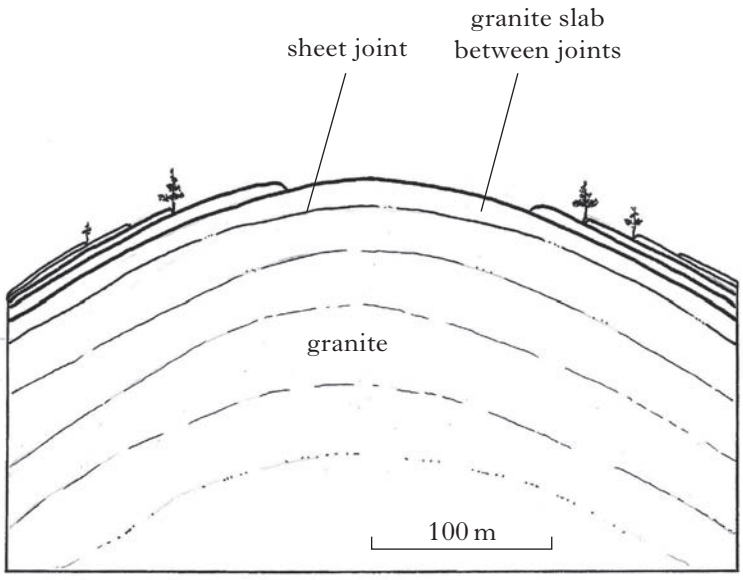
Marks

4. (continued)

(*c*) A mineral called andalusite forms within the mudstone when it is metamorphosed at temperatures between 300 and 450 °C. Use your graph to estimate the width of the zone surrounding the batholith that would contain andalusite.

Width of zone ..... m **2**

(*d*) After a long period of time the granite batholith may become similar to the present-day granite batholith shown in the diagram below. It contains slabs of granite of varying thickness separated by sheet joints.



(i) How are sheet joints formed?

.....

.....

..... **1**

(ii) How does a joint differ from a fault?

.....

.....

..... **1**

[Turn over

Marks

4. (*d*) (continued)

(iii) The table below shows the thickness of the first four slabs starting from the top of the exposed batholith.

Slab number	*Thickness of granite slabs between sheet joints* (m)
1	0·5
2	3·0
3	4·5
4	6·0

Calculate the percentage increase in thickness from slab 1 to slab 4.

Space for calculation

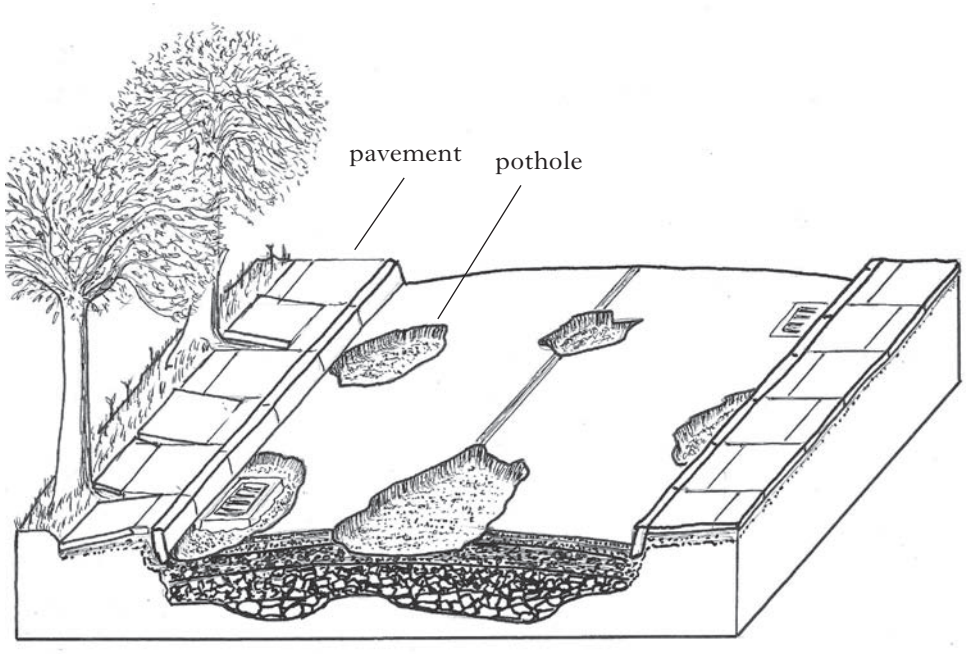
% increase in thickness **2**

[Turn over for Question 5 on *Page twelve*

DO NOT WRITE IN THIS MARGIN

Marks

5. The diagram below shows a road after three months of a hard winter. It is due to be reconstructed and resurfaced.



(*a*) Name and describe a weathering process that causes the potholing of roads in winter.

Name: .....

Description: .....

.....

..... **2**

(*b*) Explain why growing trees can cause pavements to become uneven.

.....

..... **1**

Marks

5. (continued)

(*c*) The table below gives values for some rock properties. The **higher** the value, the stronger or more resistant is the rock.

Name of rock	*Resistance to breaking up*	*Resistance to polishing*	*Resistance to being worn away*
Basalt	85	56	94
Sandstone	71	70	74
Granite	77	49	96
Limestone	77	35	86

(i) Explain why basalt is better for road surfacing than sandstone.

.....

..... **1**

(ii) Express as a simple whole number ratio, the resistance to polishing of basalt to sandstone to granite to limestone.

Space for calculation

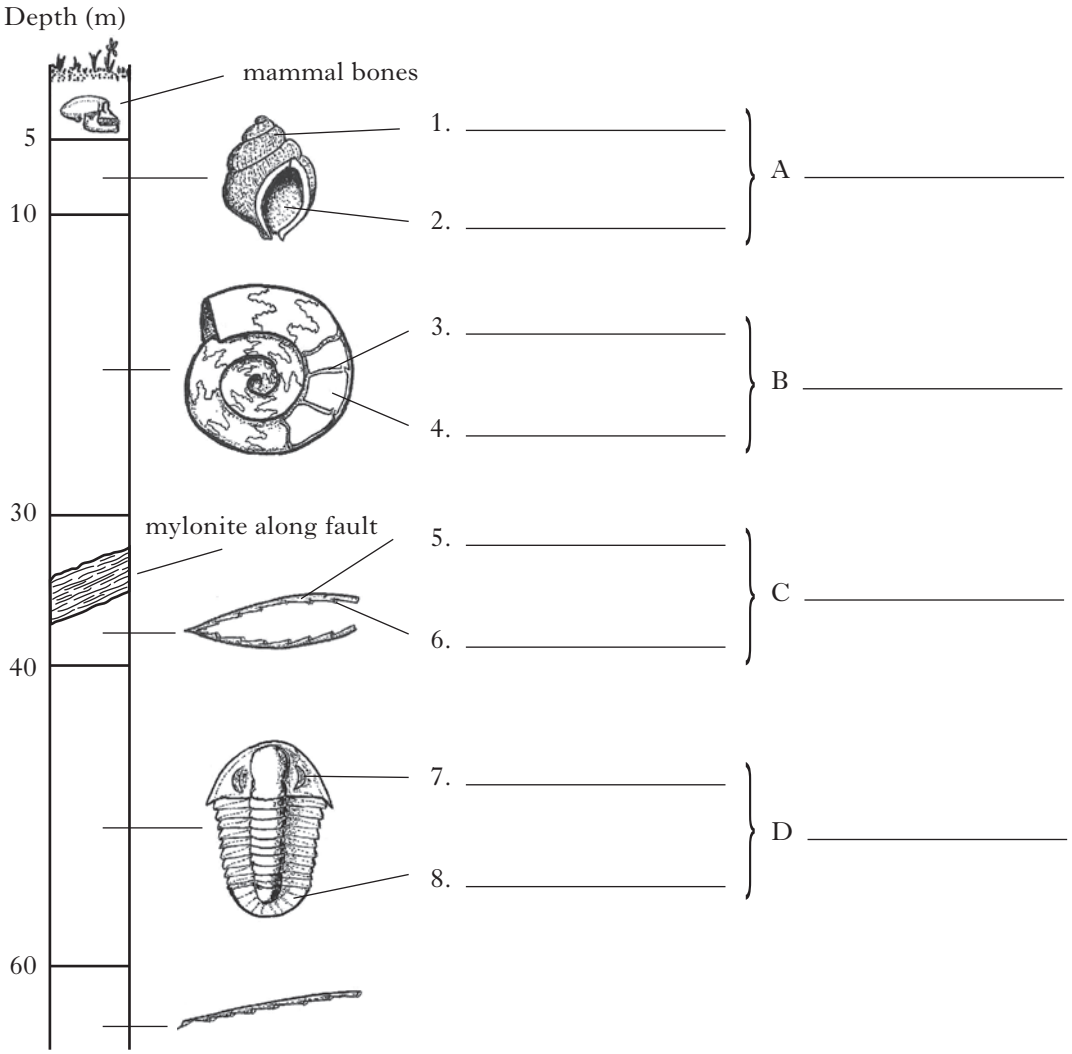
Basalt ..... : Sandstone ..... : Granite ..... : Limestone **1**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

6. The diagram below shows fossils found in a borehole.



(*a*) Name the parts of the fossils numbered 1–8 on the diagram. Use the word box below. **4**

aperture : chamber : compound eye : mouth : palial sinus : pygidium(tail) : septum : stipe : test : theca : thorax : whorl

(*b*) Name fossils A, B, C and D on the diagram. **2**

(*c*) Which **one** of the following statements is correct?

A The rocks above the fault are the right way up and the rocks below the fault are upside down.

B The rocks above the fault are upside down and the rocks below the fault are the right way up.

C All the rocks are the right way up.

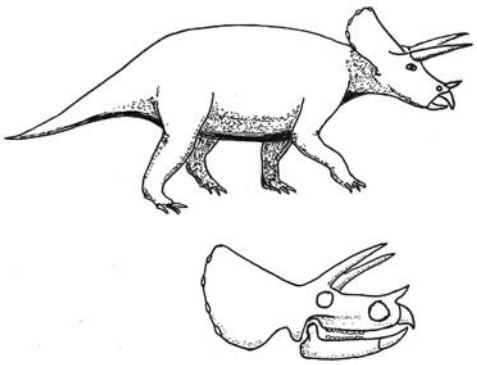
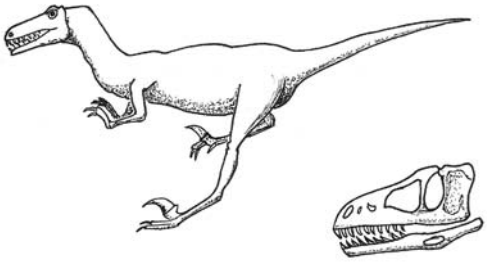
D All the rocks are upside down.

Give only the letter: **1**

Marks

6. (continued)

(*d*) Complete the table below by saying how each animal lived. Give a reason for each answer.

Animal and Skull	*How the animal lived with reason*
	How animal lived: Reason:
	How animal lived: Reason:

2

[Turn over

Marks

6. (continued)

(*e*) In the table below, place a tick (✓) beside **four** features that would suggest that a newly discovered fossil sea urchin lived in a burrow.

Feature	*Tick (✓) if the sea urchin probably lived in a burrow*
Thin test	
Thick test	
Apple shaped	
Heart shaped	
Strong teeth	
Teeth small or absent	
Many large spines	
Few small spines	

2

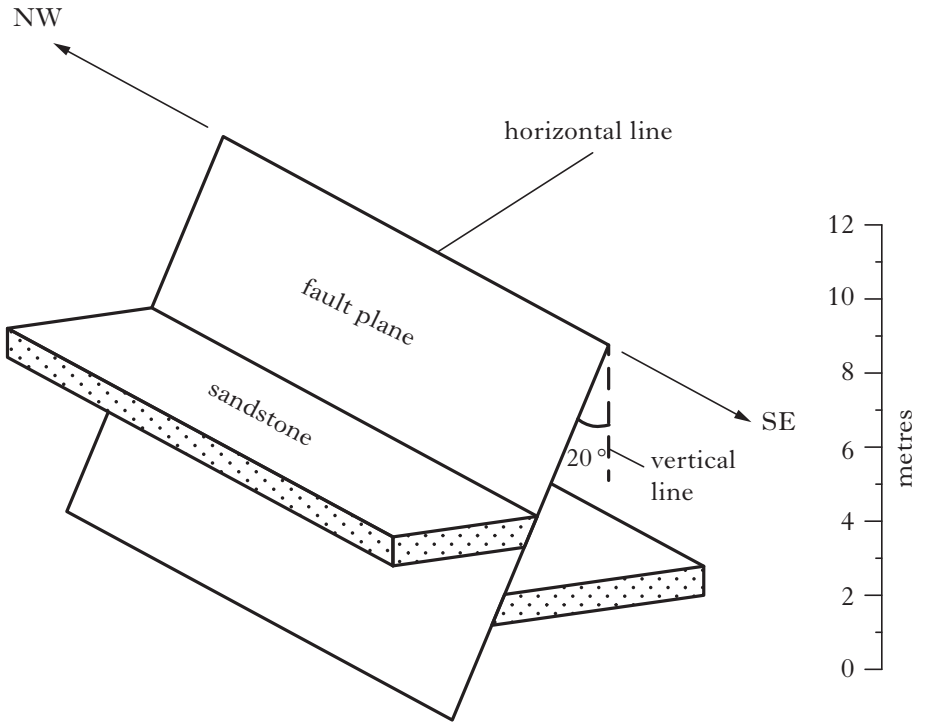
(*f*) Give an example of a trace fossil.

..... **1**

DO NOT WRITE IN THIS MARGIN

Marks

7. The diagram below shows a fault.



(*a*) What type of fault is shown?

..... **1**

(*b*) What is the direction of strike of the fault plane **in degrees**?

Direction: ..... ° **1**

(*c*) What is the angle of dip of the fault plane?

Angle of dip: ..... ° **1**

(*d*) What is the direction of dip of the fault plane?

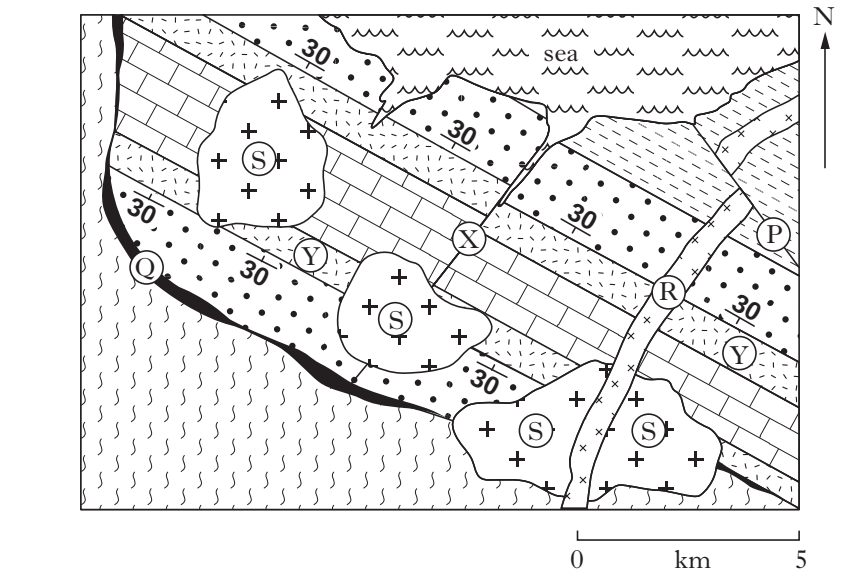
..... **1**

(*e*) By how many metres has the sandstone been displaced by the fault?

..... metres **1**

[Turn over

8. The geological map and the landscape diagram given below are of the same area.



Key

Sedimentary rocks in order of age

youngest

oldest

limestone

sandstone

shale

Igneous and metamorphic rocks not in order of age

Igneous rocks

fine-grained

medium-grained

coarse-grained

Metamorphic rocks

gneiss

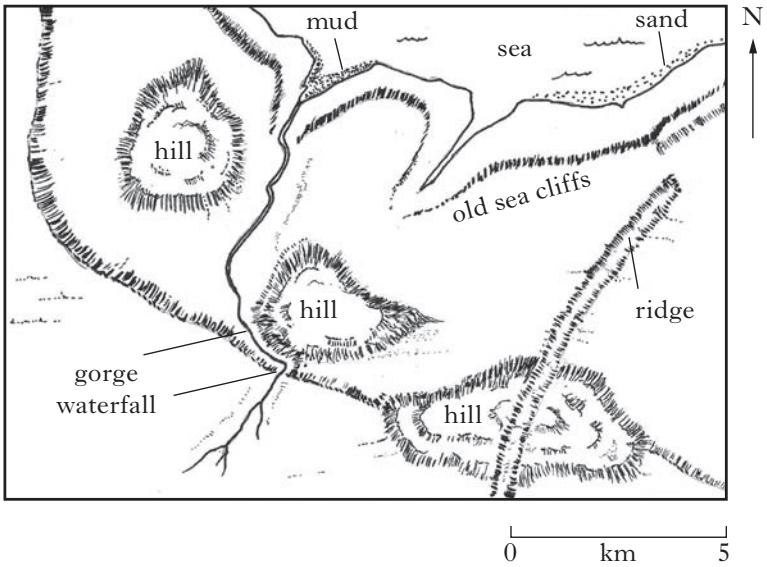
mylonite

angle of dip in degrees

30

direction of dip

direction of strike



DO NOT WRITE IN THIS MARGIN

Marks

8. (continued)

(*a*) What type of fold is shown on the geological map?

..... **1**

(*b*) On which side of fault X have the rocks been downthrown? Give a reason for your answer.

Side downthrown: .....

Reason: .....

.....

..... **2**

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

A Movement on fault Q

B Intrusion of igneous rock S

C Folding of rocks

D Intrusion of igneous rock R

E Movement on fault P

F Deposition of limestone

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

(*d*) Which **two** of the following statements are correct for the area covered by **both** maps?

A All the mud at the coast has been deposited by the river.

B The hills are made from rock formed from magma that cooled rapidly.

C The waterfall tumbles over metamorphic rock where two faults intersect.

D The old sea cliffs are composed of shale.

E The ridge follows the line of a dyke.

F The area of gneiss forms the lowest ground.

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

(*e*) Give **two** features that you would look for in the field to confirm that igneous rock Y is a lava flow and not a sill.

(i) .....

.....

(ii) .....

..... **2**

DO NOT WRITE IN THIS MARGIN

Marks

8. (continued)

(*f*) Describe **four** safety precautions that should be taken whilst carrying out fieldwork in the area of the sandy beach and old sea cliffs shown on the map.

1 .....

2 .....

3 .....

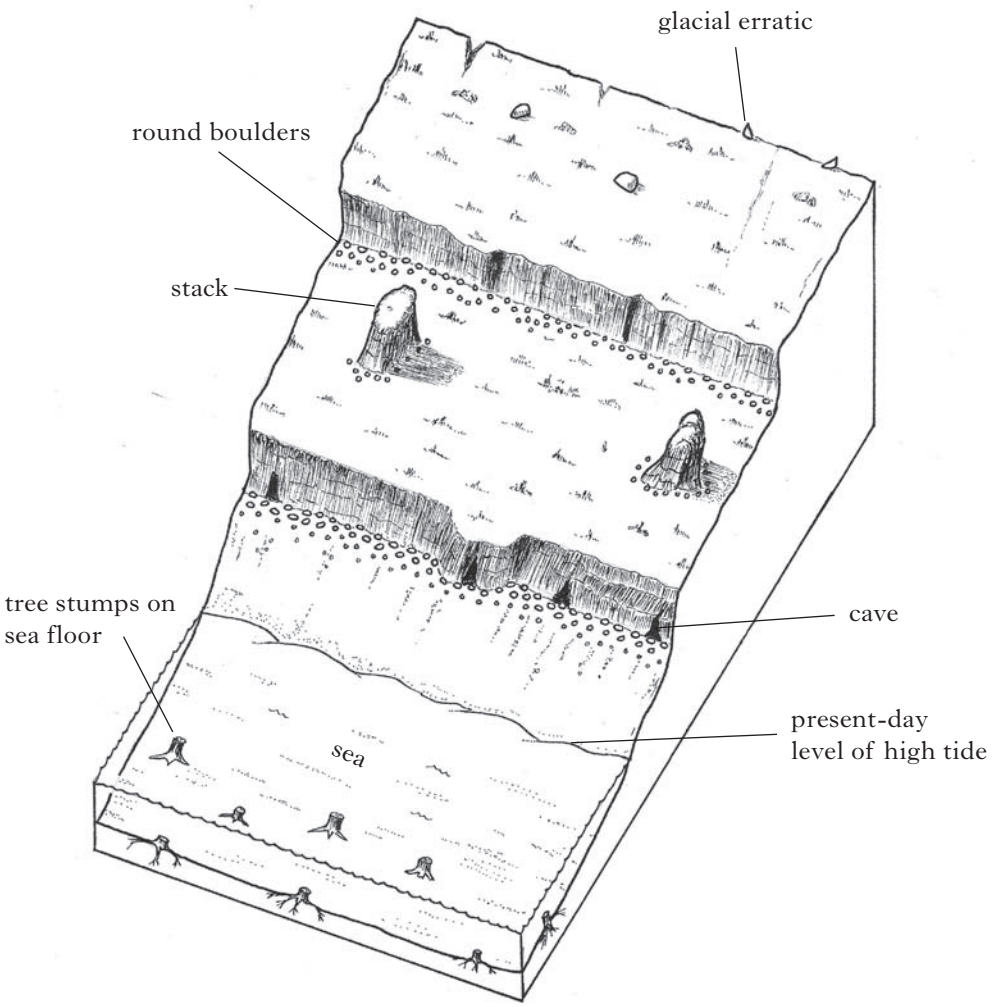
4 ..... **2**

[Turn over for Question 9 on *Page twenty-two*

DO NOT WRITE IN THIS MARGIN

Marks

9. The diagram below shows a stretch of coast.



(*a*) Use information given in the diagram to give **two** pieces of evidence that sea level has changed. Give a reason for your answer.

Evidence 1: .....

Reason 1: .....

.....

Evidence 2: .....

Reason 2: .....

..... **2**

DO NOT WRITE IN THIS MARGIN

Marks

9. (continued)

(*b*) Present-day sea level is shown on the diagram. How many **other** sea level positions have existed?

…….. **1**

(*c*) Explain why sea and land levels have changed.

……

……

……

……

……

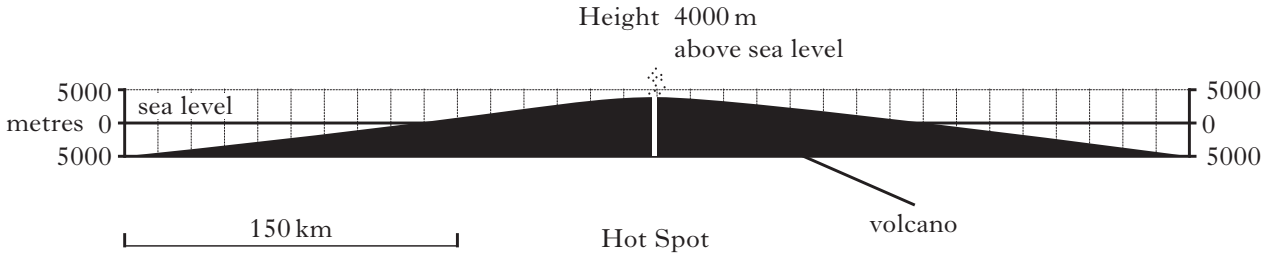
…… **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

10. Study the diagram below of a typical Hawaiian volcano. It formed over a hot spot. This is a place where magma reaches the surface from deep within the Earth.



(*a*) Underline the correct alternatives in the sentence below.

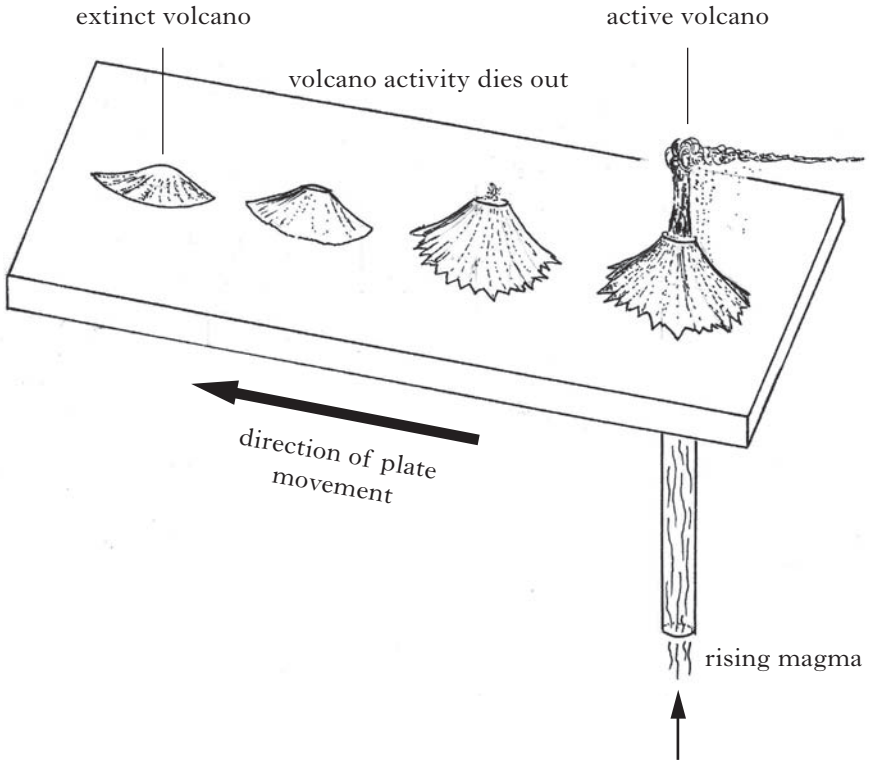
Hawaiian volcanoes that have formed over a hot spot have wide bases and gently sloping sides. This is because they are made from **runny**/**viscous** lava called **andesite**/**basalt**. **1**

(*b*) Assuming that an average lava flow is 3 m thick calculate how many lava flows there have been to form the volcano shown in the diagram above.

Space for calculation

…….. lava flows **1**

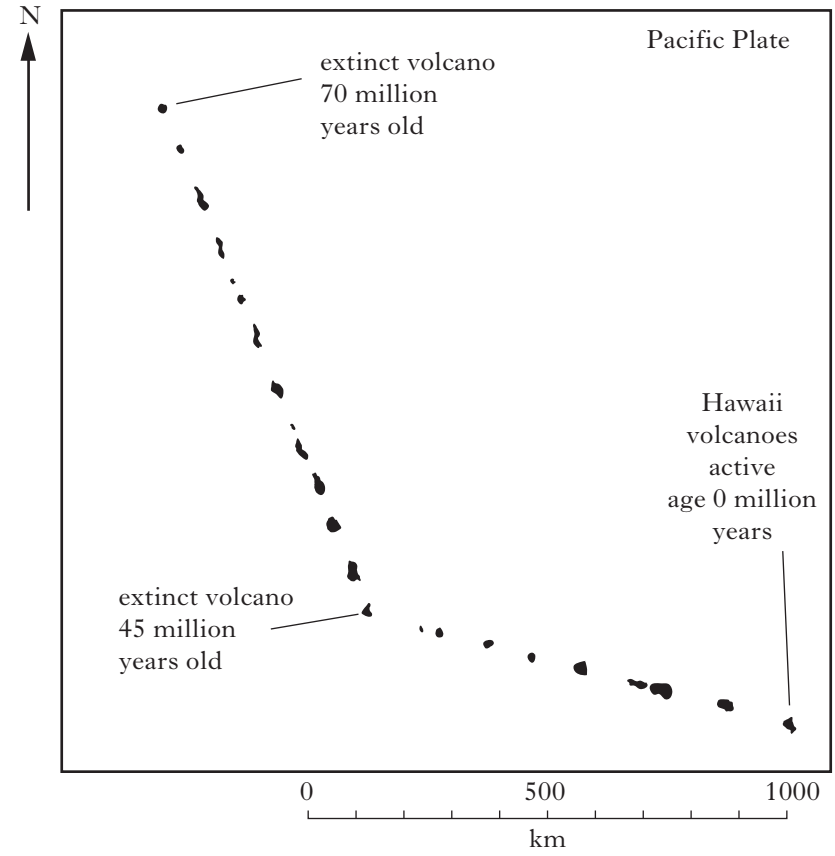
(*c*) A hot spot does not move. The diagram below shows what happens as a plate moves over a hot spot.



Marks

10. (*c*) (continued)

The diagram below shows the string of volcanoes leading away from the Hawaiian hot spot.



(i) Calculate the speed at which the Pacific Plate has been moving for the last 45 million years. Give your answer in km per million years.

Space for calculation

..... km/million years **1**

(ii) In which direction has the plate moved in the last 45 million years?

..... **1**

(iii) Which of the following statements is correct?

A The Hawaiian hotspot is unlikely to produce any more volcanoes.

B The Pacific Plate has moved in the same direction over time.

C The Pacific Plate has slowed down in the last 45 million years.

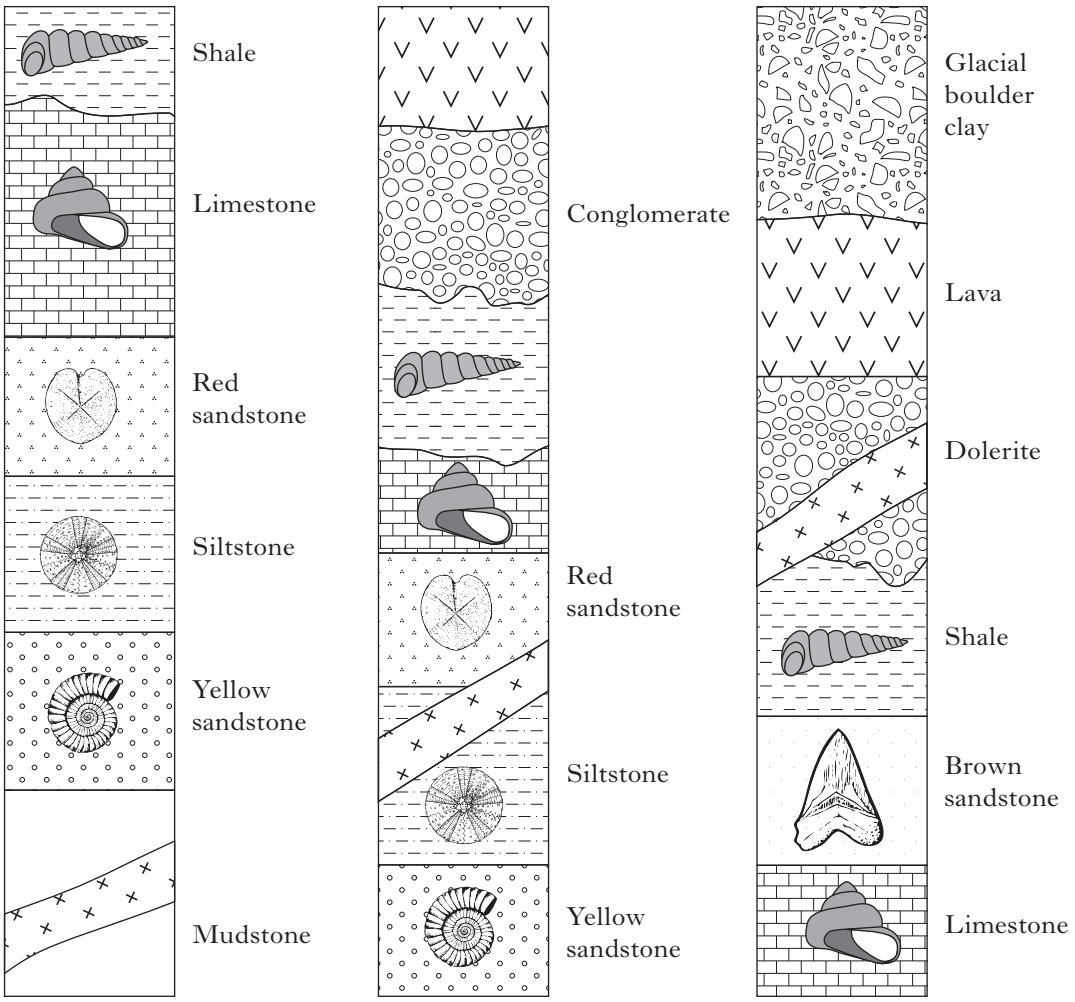
D The Hawaiian Islands are equally spaced and all the same size.

Give only the letter: **1**

DO NOT WRITE IN THIS MARGIN

Marks

11. The diagram below shows the rocks found in three boreholes.



(*a*) On the diagram draw lines to match up (correlate) the rock types in the boreholes. **2**

(*b*) Select the oldest rock from the following:

A Mudstone

B Limestone

C Yellow sandstone

D Dolerite

Give only the letter: **1**

Marks

11. (continued)

(*c*) In the table below describe the environments that would lead to the formation of the following deposits. An example has been done for you.

Deposit	*Environment that led to the deposit forming*
Mud	Slow flowing or still water in a lake or on the bed of a deep sea.
Coal	
Coral limestone	
Spherical sand grains with a rough frosted surface	

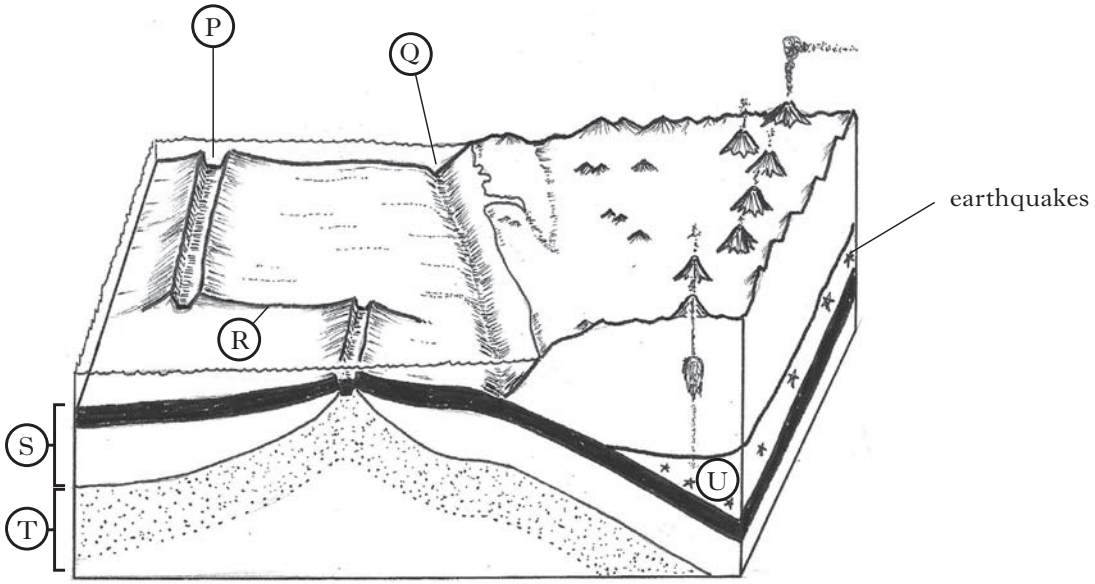
4

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

12. Study the diagram below that shows part of the west coast of Canada.



(*a*) How many plates are shown in the diagram?

..... **1**

(*b*) Complete the table by naming the features P, Q, R, S, T, and U. Use six names from the following list.

asthenosphere	conservative margin
lithosphere	magnetic stripes
oceanic trench	rift valley
site of regional metamorphism	Wadati-Benioff Zone

Feature	*Name of feature*
P	
Q	
R	
S	
T	
U	

3

DO NOT WRITE IN THIS MARGIN

Marks

12. (continued)

(*c*) The volcanoes in this area are steep sided. What type of eruption would you expect?

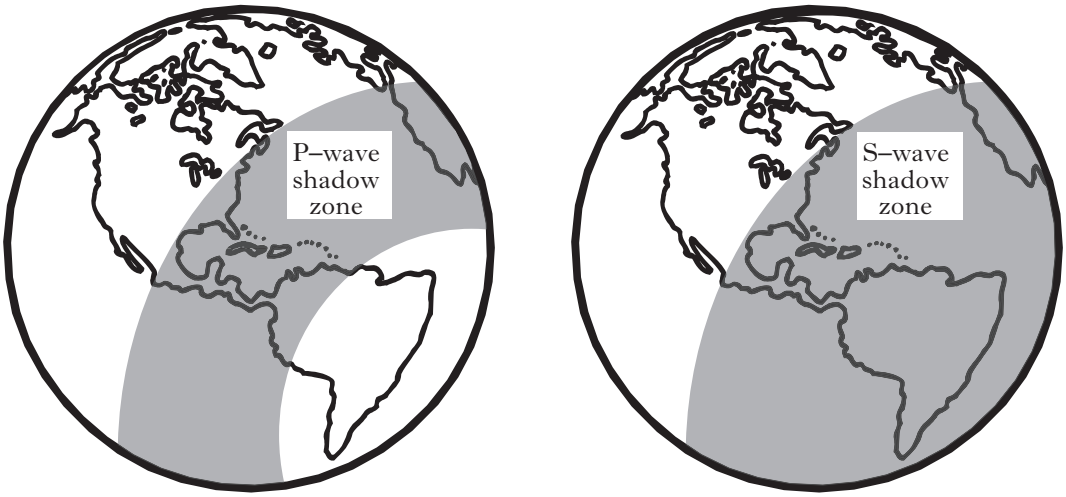
..... **1**

(*d*) Explain how a transform fault differs from a tear fault. Labelled diagrams must be used to illustrate your answer.

2

Marks

13. The diagram below shows P– and S–wave shadow zones produced by an earthquake in Japan.



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

A A P–wave shadow zone exists because the P–waves refract as they pass into and out of the core.

B The S–wave shadow zone results from the fact that S–waves can travel through the liquid outer core.

C The P–wave shadow zone varies in size and shape depending on the location of the earthquake focus.

D P– and S–waves travel through the Earth at a constant speed and in a straight line.

E The study of earthquake waves tells us where discontinuities, such as the core-mantle boundary, are located within the Earth.

F The S–wave shadow zone is half the area of the P–wave shadow zone.

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

(*b*) An earthquake produces P–, S– and L–waves. In the table below match a type of wave with a correct property.

Property of Wave	*P, S or L*
The slowest moving wave	
A compressional wave where the particles of rock are pushed close together and pulled further apart.	
A surface wave that behaves like an ocean wave.	
The particles move up and down at right angles to the wave direction.	

2

[*END OF QUESTION PAPER*]

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