FOR OFFICIAL USE

Total

X043/201

NATIONAL QUALIFICATIONS 2009

FRIDAY, 29 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

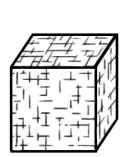
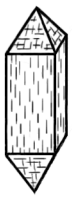
Number of seat

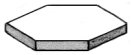
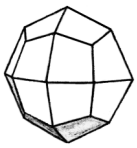
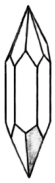
1 You should attempt **all** of the questions.
2 All answers should be written in the spaces provided in this answer book and should be written clearly and legibly in ink.
3 The marks allocated to each question or part of a question are shown at the end of each question or part of a question.
4 Before 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.

All questions should be attempted.

1. (*a*) Use **eight** of the following from the box to complete the table below.

grey, brassy yellow, dark red, white,
1, 2, 3, 5, 7


Colour	*Streak colour*	*Number of cleavages*	*Hardness*	*Crystal shape*	*Name of mineral*
Dark brown or black	white				Biotite
	white	none			Garnet
Clear or white			3		Calcite
Silvery		3	2		Galena

DO NOT WRITE IN THIS MARGIN

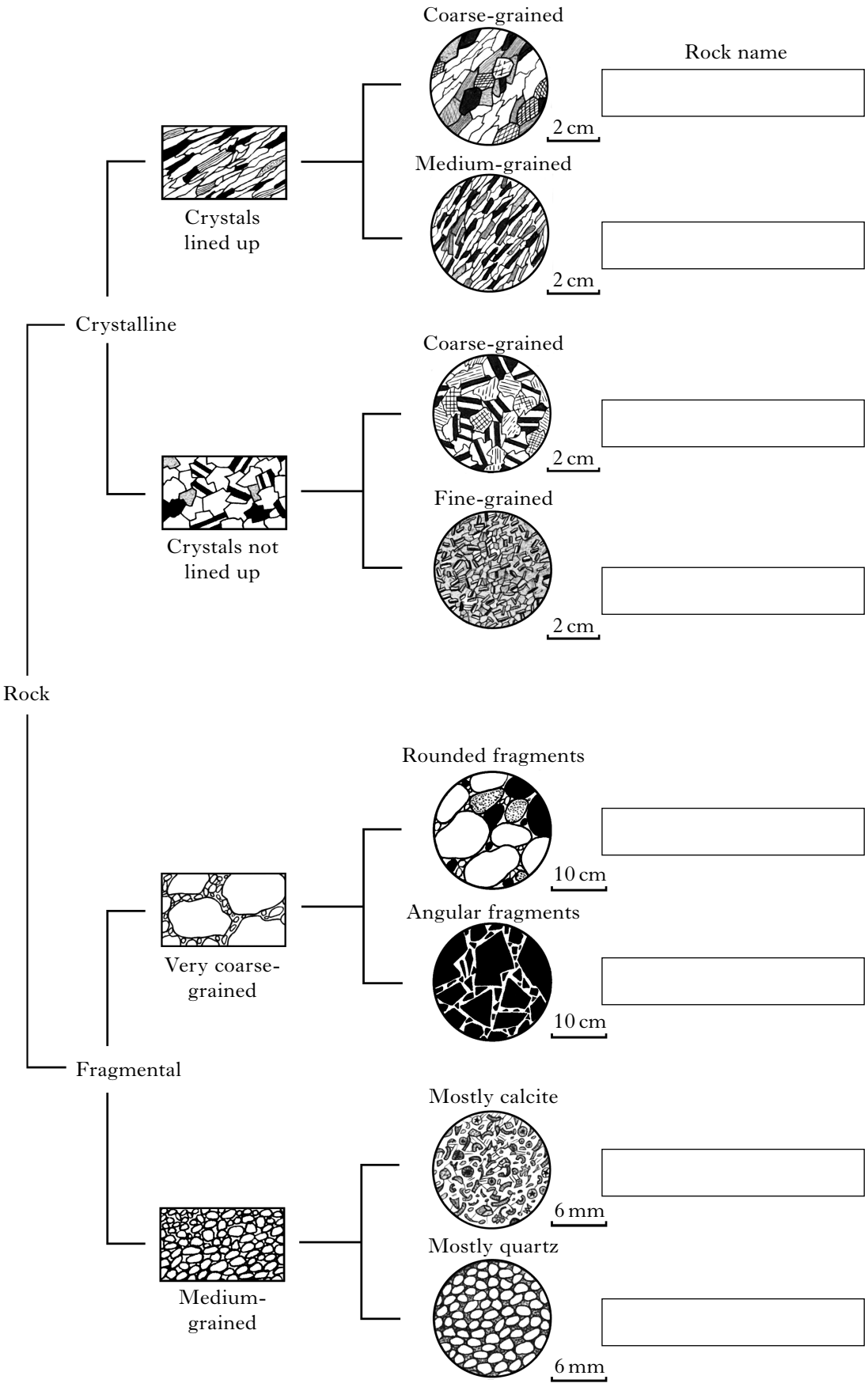
Marks

4

(*b*) Use **eight** of the rock names from the word box to complete the key below.

Marks

basalt, breccia, conglomerate, dolerite, gabbro, gneiss, limestone, marble, obsidian, sandstone, schist, slate



4

Marks

1. (continued)

(*c*) Which **two** of the following statements correctly describe mylonite?

A Mylonite is thermally metamorphosed mudstone.

B All mylonites are formed along thrust faults.

C Mylonite is usually coarse grained.

D Mylonite is finely banded streaky rock formed by intense squeezing and stretching of any rock.

E Mylonites may be formed in shatter zones.

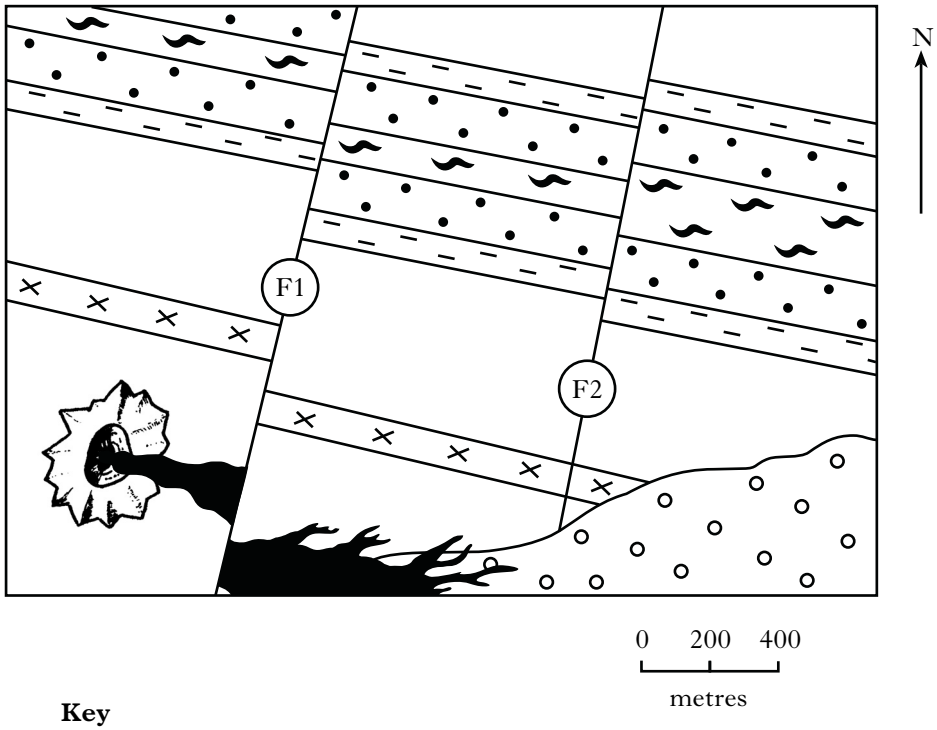
F Mylonite forms as a result of dynamic metamorphism.

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

[Turn over for Question 2 on *Page six*

Marks

2. Study the map.



Key

Sedimentary rocks in order of age

youngest

conglomerate

limestone

shale

sandstone

oldest

Igneous and metamorphic rocks not in order of age

dolerite

gneiss

basalt lava

ancient volcano

F1 fault

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

..... **1**

(ii) On the map, insert symbols ( ) to show the directions of strike and dip in the limestone on each side of the fold. **1**

DO NOT WRITE IN THIS MARGIN

Marks

2. (continued)

(*b*) (i) What type of fault is F1?

..... **1**

(ii) In what direction and how far have the rocks on the west side of fault F1 been moved?

Direction of movement: .....

How far the rocks have moved: ..... metres **1**

(*c*) (i) How many unconformities are shown on the map?

..... **1**

(ii) How many dykes are shown on the map?

..... **1**

(*d*) How can you tell that the rocks on the west side of the fault F2 have been moved down in relation to the rocks on the east side?

.....

.....

..... **1**

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

A Intrusion of dolerite

B Formation of gneiss

C Eruption of lava

D Movement on fault F2

E Deposition of conglomerate

F Movement on fault F1

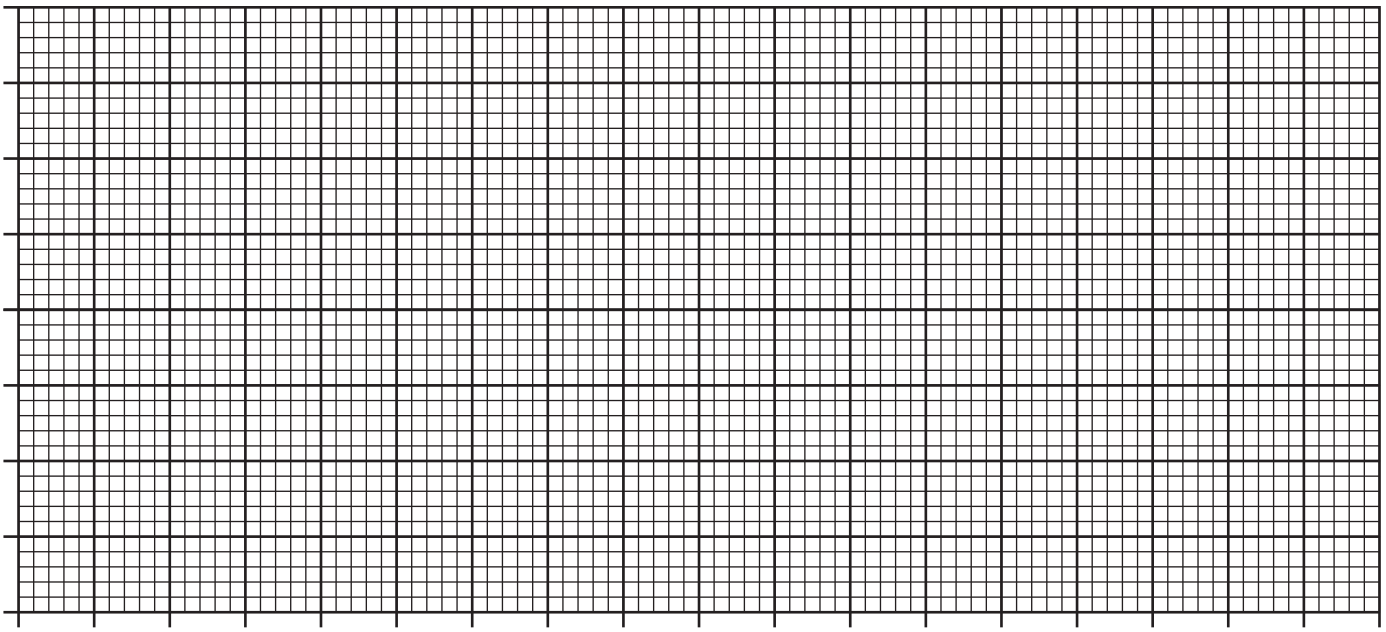
Give only the letters: ..... → ..... → ..... → ..... → ..... → .....
oldest youngest **3**

[Turn over

3. Quartz spheres of different sizes were dropped into water. The speeds at which they sank are shown in the table.

Diameter of quartz sphere (mm)	*Speed of sinking* (cm per second)
0·0	0·0
0·6	7·0
1·0	10·0
2·0	15·0
4·0	20·0
10·0	30·0
16·0	35·0

(*a*) (i) On the graph paper provided below, draw a line graph to show how speed of sinking changes with the diameter of the quartz spheres.



DO NOT WRITE IN THIS MARGIN

Marks

3

Marks

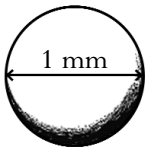
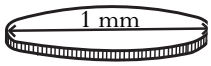
3. (*a*) (continued)

(ii) Describe the general relationship shown by the graph.

.....

..... **2**

(*b*) Complete the table by saying if the mineral grain would sink more slowly or more quickly than a quartz sphere with a 1 mm diameter. Give a reason for each answer.

Name of mineral	*Grain size and shape*	*Density of mineral* (g/cm^3)	*Rate of sinking* (*slower or faster than a quartz sphere*)	*Reason*
cassiterite	1 mm sphere 	7·0		
mica	1 mm flake 	2·7		
quartz	1 mm angular 	2·7		

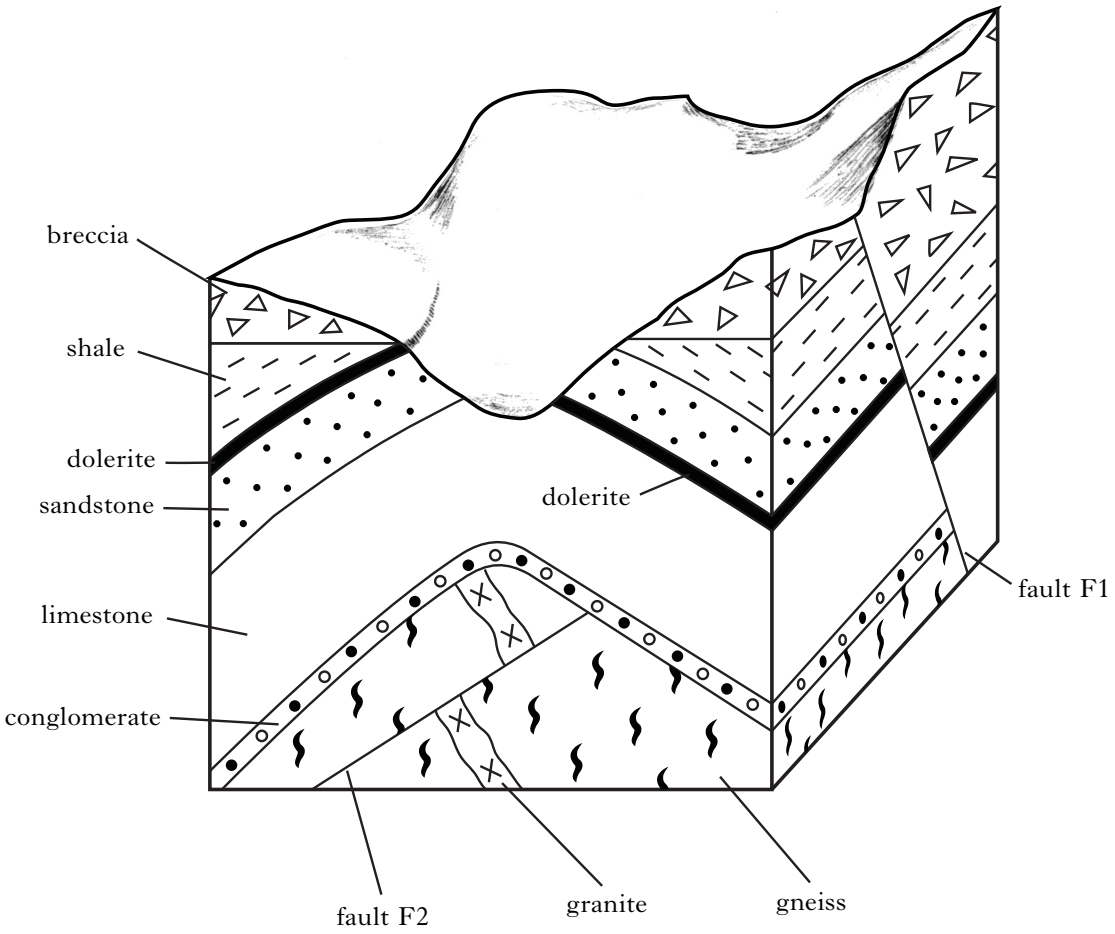
3

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

4. Study the block diagram.



(*a*) (i) What type of fault is F1?

..... **1**

(ii) What type of fault is F2?

..... **1**

(*b*) From the diagram, how can you tell that the dolerite forms a sill and not a lava flow?

.....

..... **1**

(*c*) (i) On the diagram, shade and label an area where you would expect to find marble. **1**

(ii) On the diagram, shade and label an area where you would expect to find hornfels. **1**

Marks

4. (continued)

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

A Folding of conglomerate

B Deposition of sandstone

C Movement on fault F2

D Movement on fault F1

E Intrusion of granite

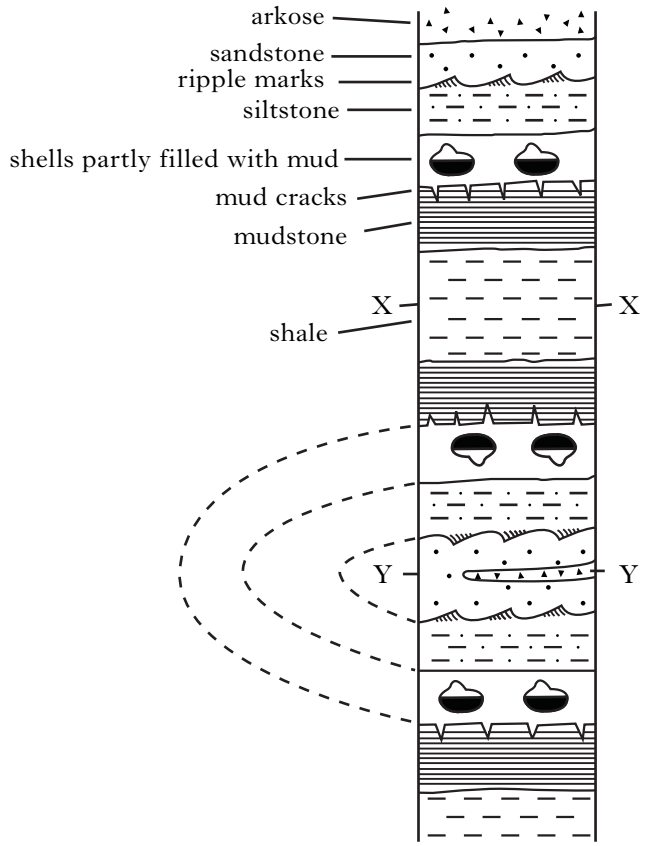
F Deposition of breccia

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

[Turn over

5. (*a*) The rocks shown in the borehole diagram below have been folded.

Marks



(i) Name **three** structures which show that the rocks between X and Y have been turned upside down. Give a reason for each answer.

Structure .....

Reason .....

.....

.....

Structure .....

Reason .....

.....

.....

Structure .....

Reason .....

.....

.....

3

Marks

5. (*a*) (continued)

(ii) Using four dashed lines, complete the fold in the space to the right of the borehole diagram. **1**

(iii) Name the oldest rock in the borehole.

..... **1**

(*b*) The diagram shows a piece of coal. Describe the processes involved in forming coal. You may use diagrams in your answer.

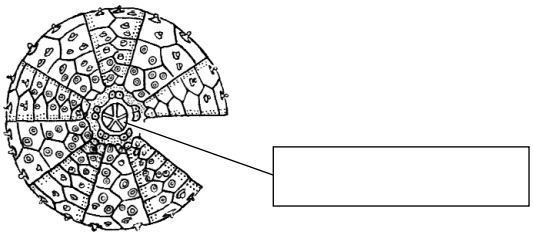
3

DO NOT WRITE IN THIS MARGIN

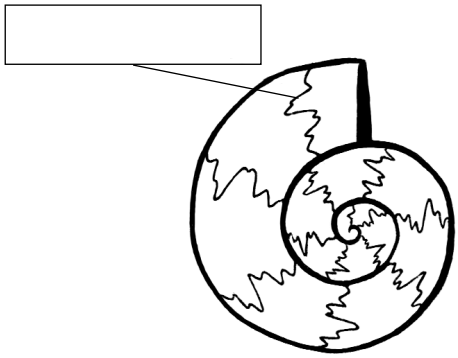
6. (*a*) (i) Name the parts of the fossils.

Marks

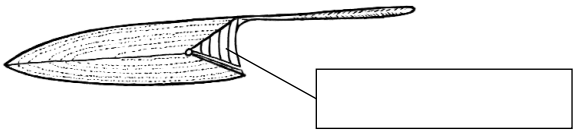
Fossil P



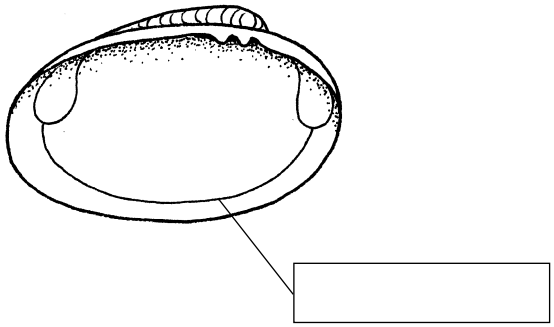
Fossil Q



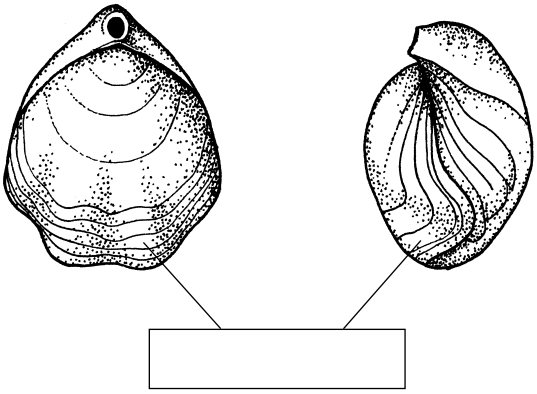
Fossil R



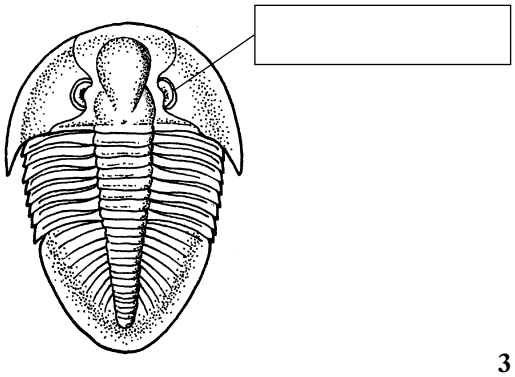
Fossil S



Fossil T



Fossil U



3

(ii) Name fossils P, Q, R, S, T and U.

Name of fossil P .....

Name of fossil Q .....

Name of fossil R .....

Name of fossil S .....

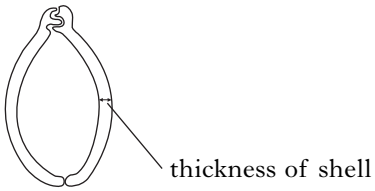
Name of fossil T .....

Name of fossil U **3**

Marks

6. (continued)

(*b*) Bivalve shells are made from calcium carbonate that the animal extracts from water. The table gives the thicknesses of shells of bivalves living in different environments.

Environment of bivalve	*Thickness of shell* (mm) 
Bed of rapidly flowing river	1·0
Attached to rocks between high and low tides. Often affected by strong waves. Many predators.	2·5
Floor of deep sea. Bivalve does not burrow. Weak currents. Few predators.	1·5

(i) Account for the following two observations.

The thinnest shells are found in the river.

.....

..... **1**

The thickest shells are found between high and low tides.

.....

..... **1**

(ii) Predict a possible thickness for the shell of a bivalve that lives in burrows on the sea bed and has no predators.

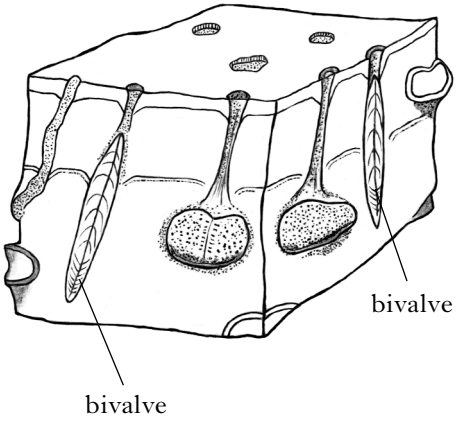
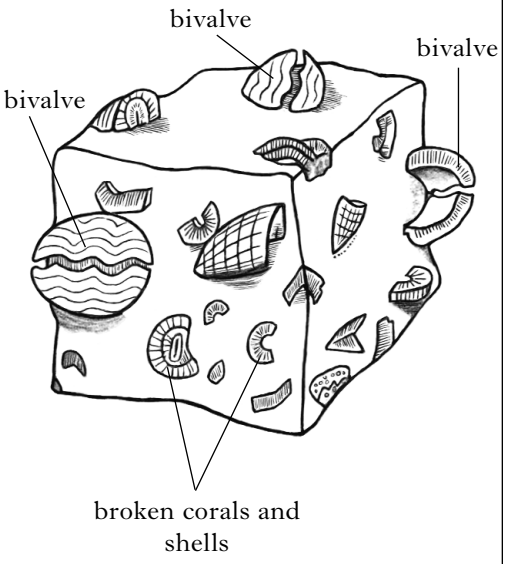
..... **1**

[Turn over

Marks

6. (continued)

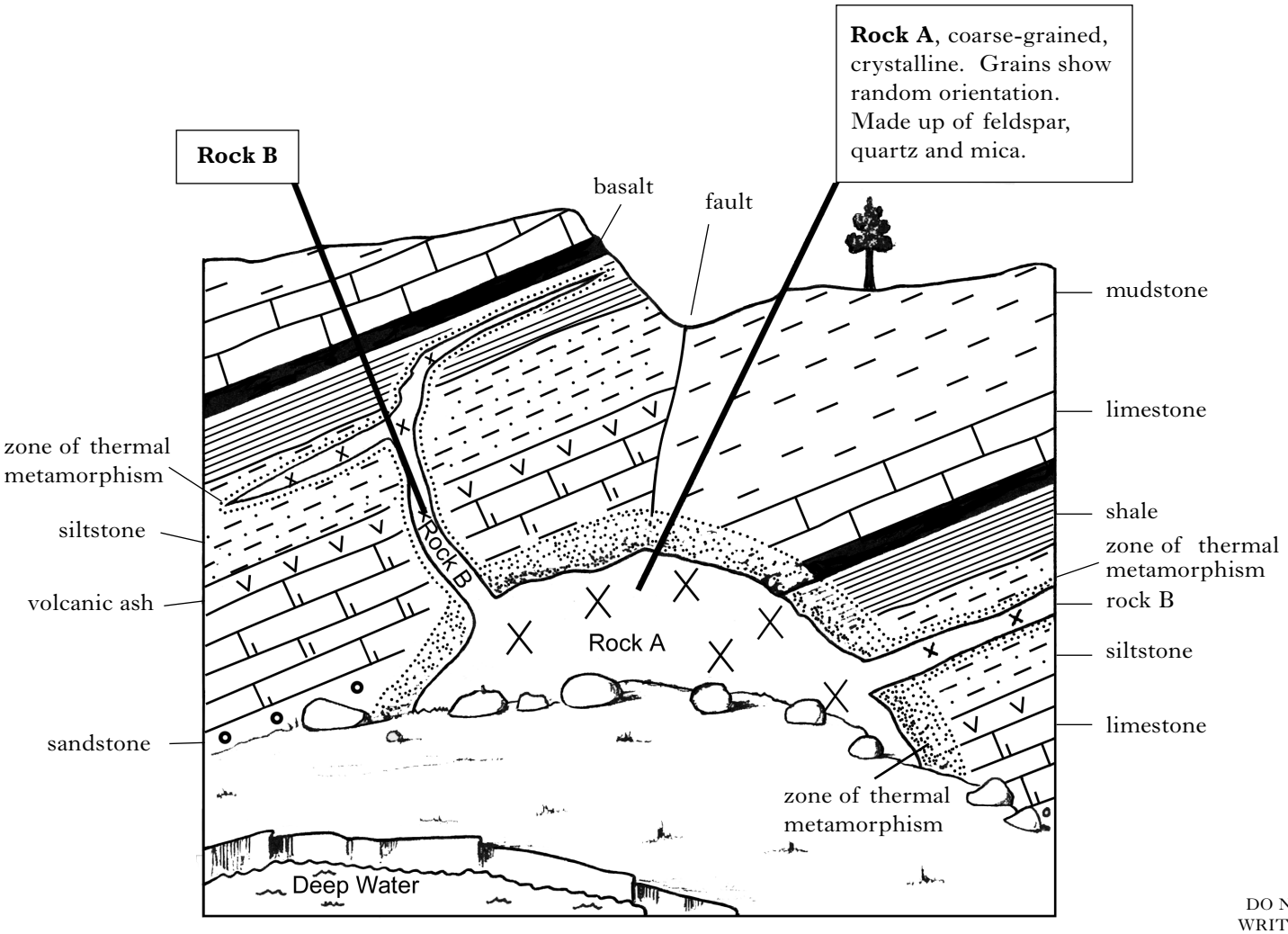
(*c*) Complete the table by saying how the fossil bivalve lived and by saying how the shape of the bivalve was suited to its way of life.

Rock showing fossil bivalve	*How the bivalve lived*	*How the shape of the shell suited its way of life*
		
		

3

[Turn over for Question 7 on *Page eighteen*

7. (*a*) This is a field sketch made by a student in **quarry X**.



DO NOT WRITE IN THIS MARGIN

Marks

(i) Name rock type A.

..... **1**

(ii) Explain why the zone of thermal metamorphism varies in width around rocks A and B.

.....

.....

..... **1**

DO NOT WRITE IN THIS MARGIN

Marks

7. (*a*) (continued)

(iii) Identify **two** risks that are present in **quarry X** and state how they could be reduced.

Risk 1 .....

How risk could be reduced .....

.....

.....

Risk 2 .....

How risk could be reduced .....

.....

..... **2**

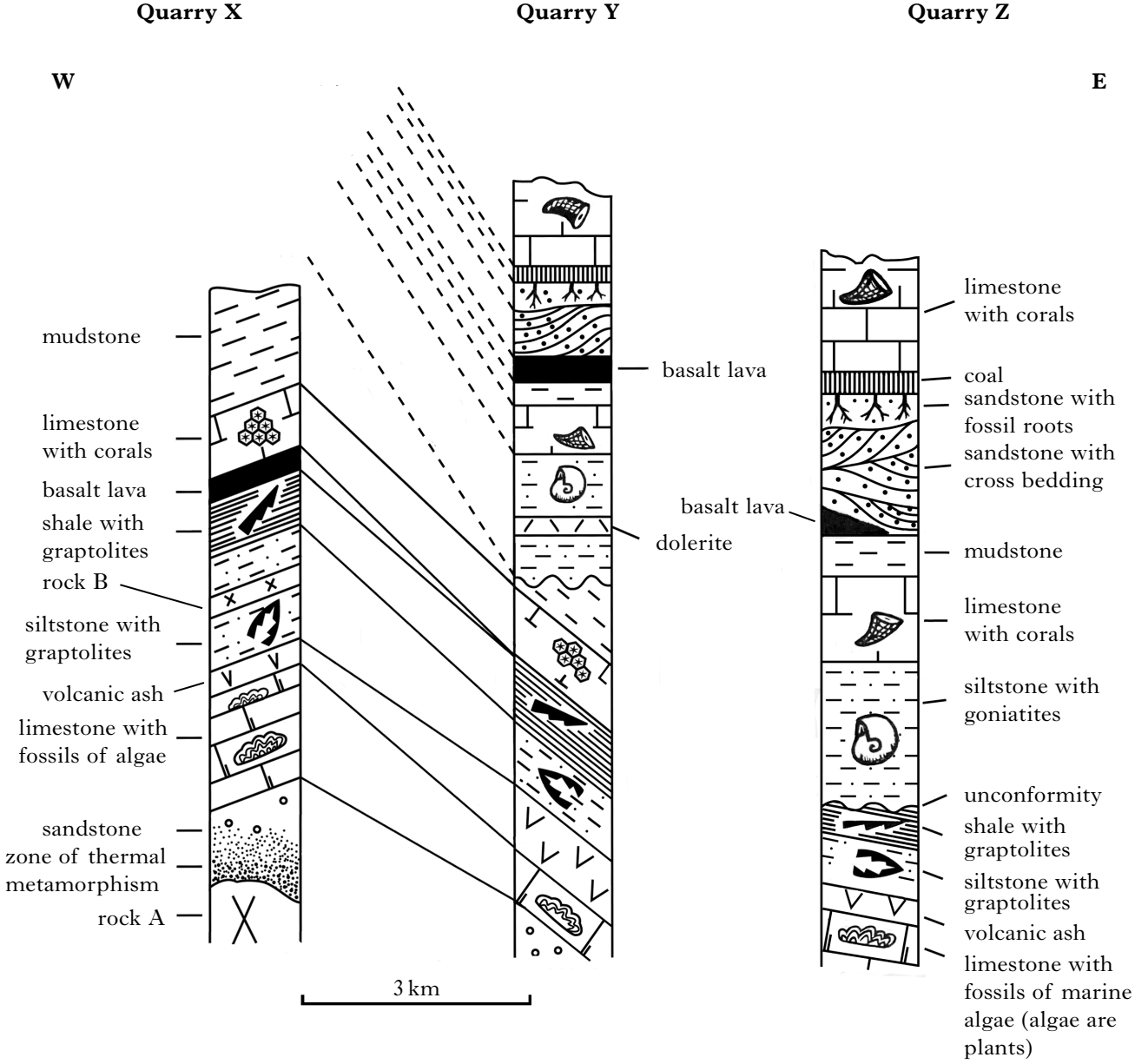
[Turn over

Marks

7. (continued)

(*b*) The diagram shows the rock sequences in quarry X and in two other quarries, Y and Z, which both lie to the East of quarry X. Lines have been drawn to show the correlation between the rocks in quarries X and Y.

(i) On the diagram, draw lines between the rock sequences to match up (correlate) the rocks in the quarries Y and Z.



3

Marks

7. (*b*) (continued)

(ii) The table shows some of the rocks in quarry Y. Complete the table.

Age	*Sedimentary rock*	*Environment of deposition*	*Reason for coming to this conclusion*
Youngest	sandstone with cross bedding		
↑	limestone with corals		
↑	siltstone with goniatites		
↑	shale with graptolites	sea with weak bottom currents	
Oldest	limestone with marine algae		Algae are plants hence they need light to survive. Light does not penetrate to deep water

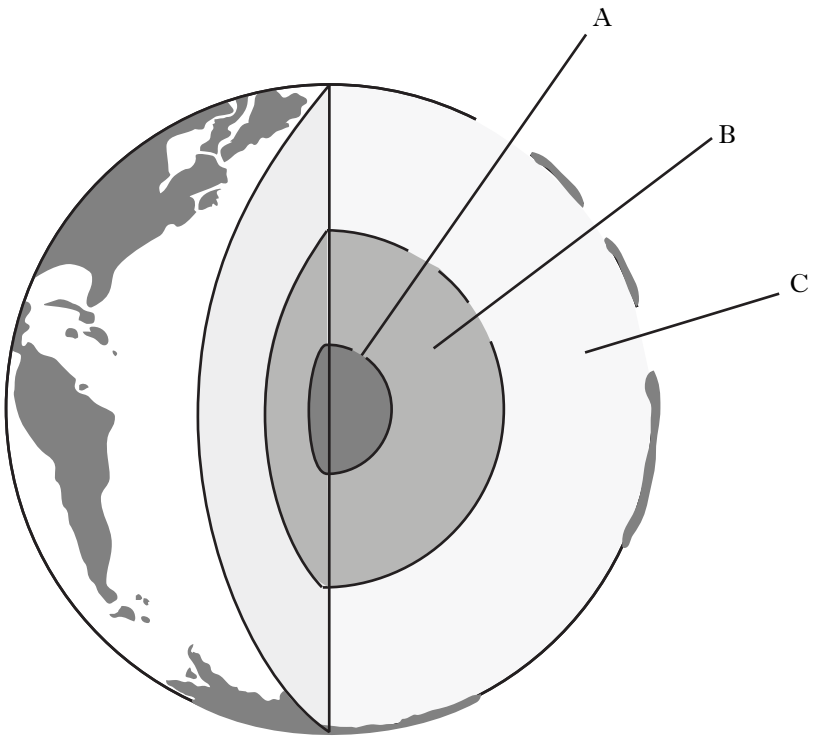
4

[Turn over

[BLANK PAGE]

Marks

8. (*a*) Using the diagram of the Earth given below, name layers A, B and C and then name the material or materials making up each layer.



Layer	*Name*	*Material or Materials making it up*
A		
B		
C		

3

[Turn over

Marks

8. (continued)

(*b*) How does the speed of P–waves change when they move from layer B into layer A? Explain your answer.

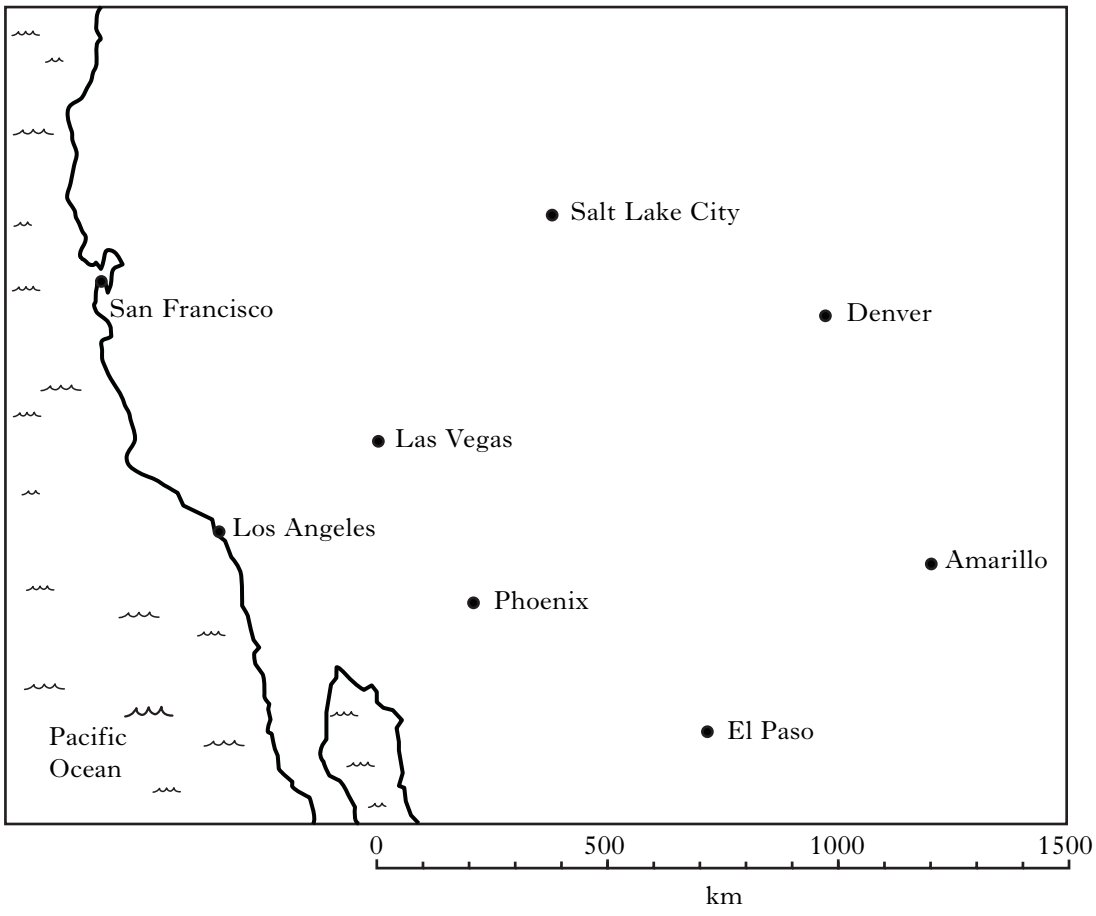
Change in speed .....

Explanation .....

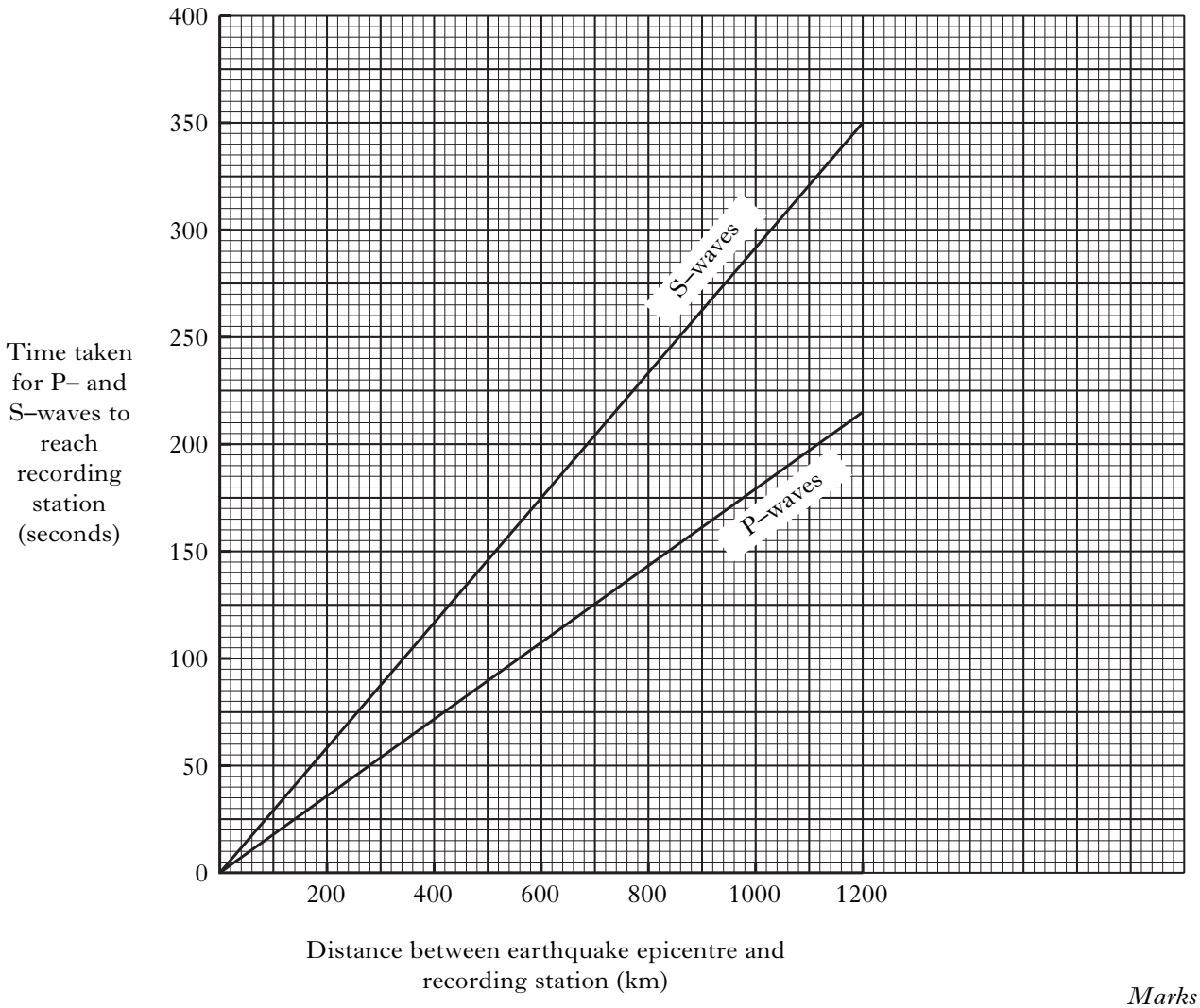
.....

..... **2**

(*c*) The map shows part of the USA and Mexico. The graph shows time plotted against distance for P– and S–waves from an earthquake.



8. (*c*) (continued)



Marks

(i) $\text{Speed} = \dfrac{\text{Distance}}{\text{Time}}$

From the graph, calculate the speeds of the P– and the S–waves.

Speed of P–waves: ..... km per second **1**

Speed of S–waves: ..... km per second **1**

Space for working

DO NOT WRITE IN THIS MARGIN

Marks

8. (*c*) (continued)

(ii) Which waves (P or S) would be the first to reach a recording station at any distance from the earthquake epicentre?

..... **1**

(iii) As distance from the epicentre increases, what happens to the time interval between the arrival of the P– and S–waves?

..... **1**

(*d*) (i) An earthquake took place at a position on the map. Use the graph to complete the table.

Position of earthquake recording station	*Time interval between the arrival of the P– and S–waves* (seconds)	*Distance between epicentre and recording station* (km)
Amarillo	125	
Los Angeles	85	
Denver	80	

3

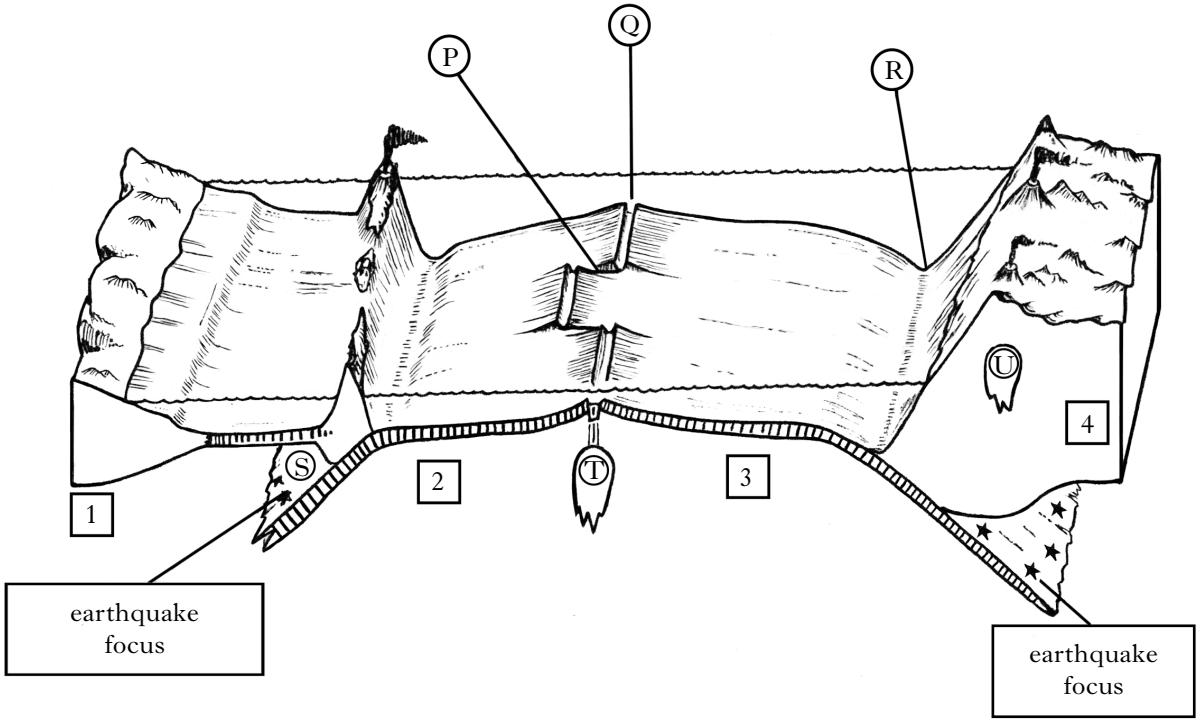
(ii) Using the scale on the map:

1 draw circles centred on Amarillo, Los Angeles and Denver which have radii equal to the distances between the epicentre and the recording stations; **2**

2 label the epicentre. **1**

Marks

9. The diagram shows plates.



(*a*) How many plates are shown?

..... **1**

(*b*) Match six of the features below with the letters P, Q, R, S, T and U shown in the diagram above.

Feature	*Letter*
Basalt magma chamber	
Island arc	
Zone of regional metamorphism	
Destructive plate margin	
Constructive plate margin	
Conservative plate margin	
Wadati-Benioff Zone	
Granite intrusion	

3

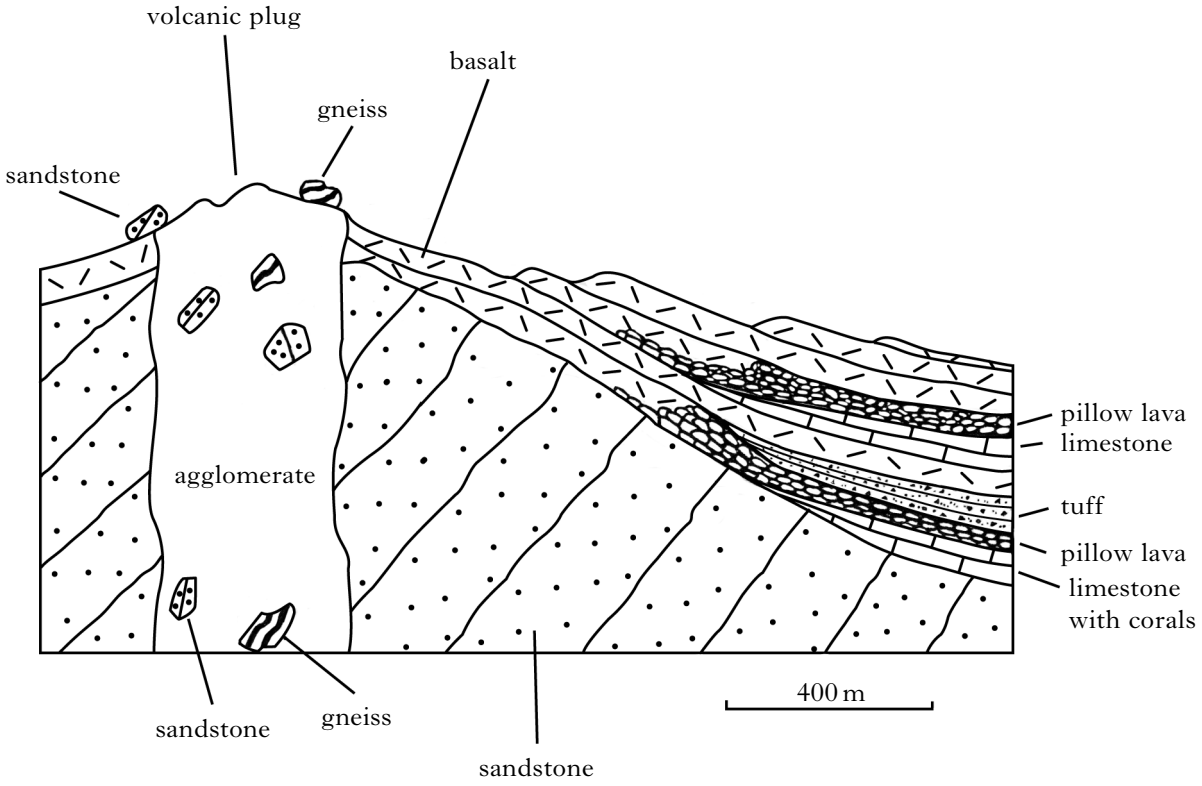
(*c*) On the diagram, draw arrows at positions 1, 2, 3 and 4 to show the directions of plate movements. **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

10. The diagram shows a section through an ancient volcano and nearby rocks.



(*a*) Explain why the basalt sometimes shows pillow structure.

..... **1**

(*b*) Give **one** piece of evidence that suggests that the volcanic plug previously extended to a higher level.

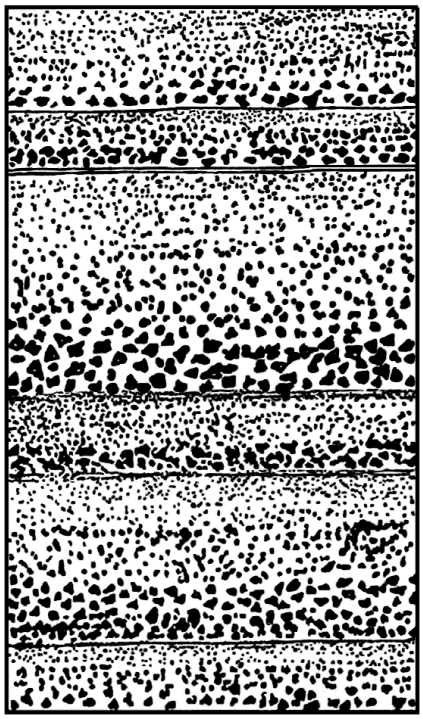
.....

..... **1**

Marks

10. (continued)

(*c*) The tuff lies in beds of the type shown in the diagram.



(i) Name this type of bedding and say how it was formed.

Type of bedding **1**

How formed .....

.....

.....

..... **2**

(ii) Explain why the beds are of different thicknesses.

.....

.....

..... **1**

[Turn over for Question 10 (*d*) on *Page thirty*

10. (continued)

Marks

(*d*) Which statement is correct?

A Agglomerate is an igneous rock made up of xenoliths.

B The limestone with corals was deposited in a lake.

C The gneiss forms a xenolith.

D The basalt forms lava flows that are all the same age.

Give only the letter: **1**

[*END OF QUESTION PAPER*]

[BLANK PAGE]

[BLANK PAGE]