FOR OFFICIAL USE

Centre No.	Subject No.	Level	Paper No.	Group No.	Marker's No.

Total

[C043/SQP085]

Intermediate 2 Geology

Time: 2 hours

NATIONAL QUALIFICATIONS

Specimen Question Paper

Fill in these boxes and read what is printed below.

Full name of centre

Town

First name and initials

Surname

Date of birth

Day Month Year

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.

Candidates must not write in this margin

Marks

1. How would you tell the difference between the following pairs of minerals and rocks?

(*a*) **Haematite and pyrite**

Property of haematite: .....

.....

Property of pyrite: .....

..... **(1)**

(*b*) **Granite and dolerite**

Property of granite: .....

.....

Property of dolerite: .....

..... **(1)**

Marks

2. Figure Q2(1) shows a sequence of rocks.

Figure Q2(2) is a magnified view of Rock X.

Figure Q2(1)

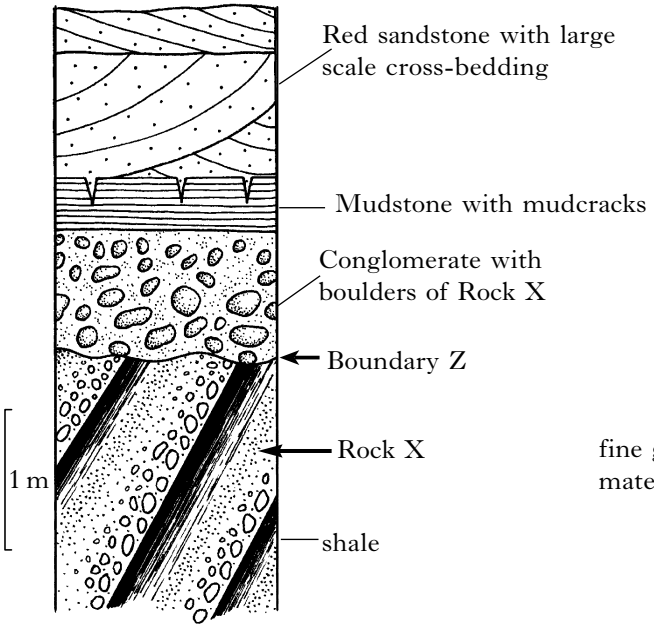
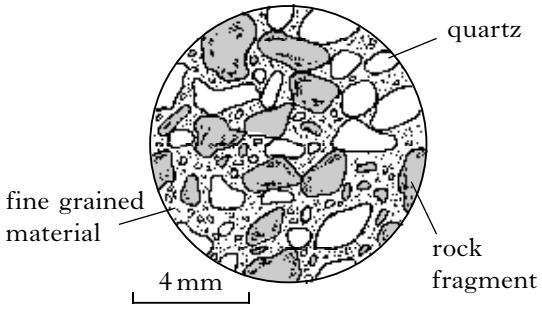


Figure Q2(2)



(*a*) Give **two** pieces of evidence from Figures Q2(1) and Q2(2) which suggest that Rock X is sedimentary.

1 .....

.....

2 .....

..... **(2)**

Marks

2. (continued)

(*b*) Which **two** statements correctly describe features shown in Figure Q2(1)?

A The rocks below Boundary Z have been turned upside down by folding.

B The conglomerate is younger than the mudstone.

C Boundary Z is an unconformity.

D The shale was deposited in shallow water.

E Boundary Z is a thrust fault.

F The mudstone and sandstone were deposited under arid conditions.

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

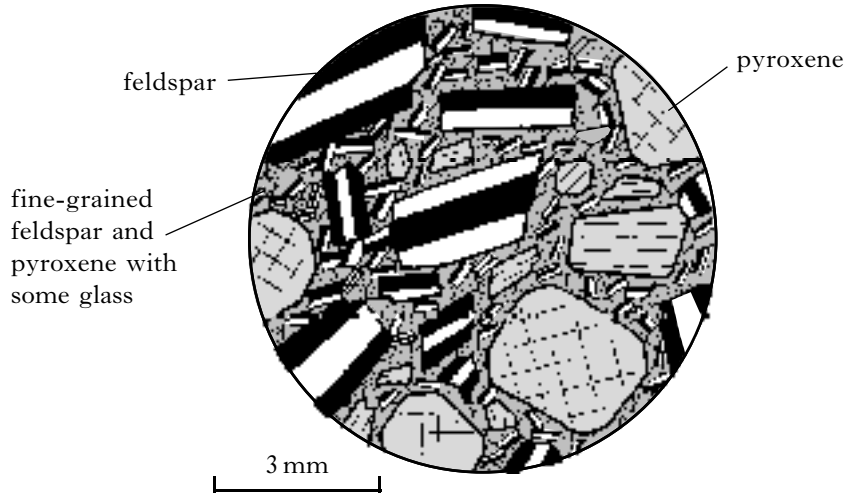
(*c*) Use diagrams to explain how graded bedding is formed.

(2)

Marks

3. Figure Q3 shows a magnified igneous rock.

Figure Q3



(*a*) What is a phenocryst?

.....

..... **(1)**

(*b*) Describe the conditions under which the igneous rock cooled.

.....

.....

..... **(2)**

(*c*) Name the rock.

..... **(1)**

Marks

3. (continued)

(*d*) In the field, how would you distinguish between a sill and a lava flow? Give **three** ways.

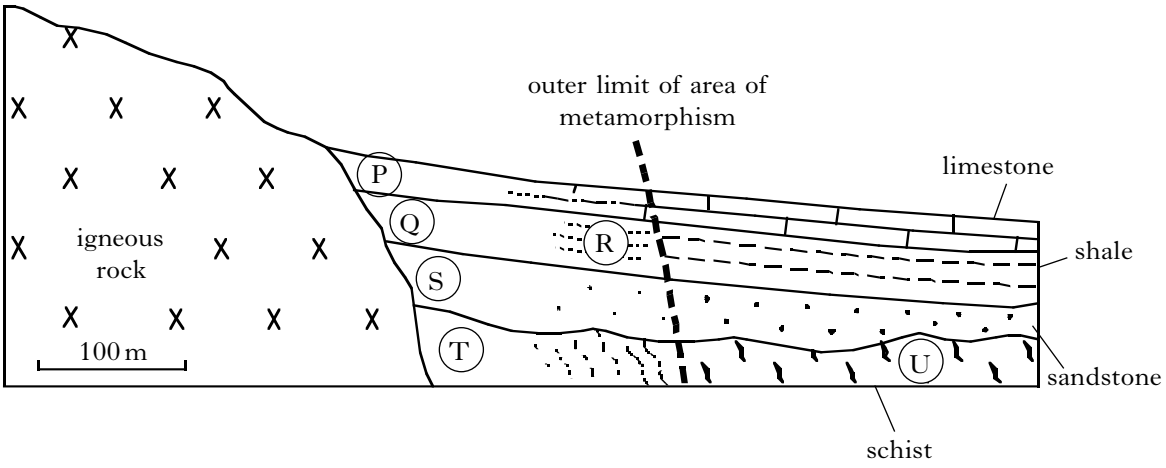
Diagrams may be used.

(3)

Marks

4. Figure Q4 shows how an igneous intrusion affects the rocks round about it.

Figure Q4



(*a*) Name rocks (P) and (S).

Name of rock (P) :.....

Name of rock (S) :..... **(1)**

(*b*) Name rocks (Q) and (R) and describe **one** way in which they differ.

Name of rock (Q) : .....

Name of rock (R) : ..... **(2)**

One way in which the rocks differ: .....

..... **(1)**

(*c*) Describe **one** way in which rock (T) differs from rock (U).

.....

..... **(1)**

Marks

4. (continued)

(*d*) Which statement is correct?

A The area of metamorphic rock around an intrusion is called a metamorphic aureole.

B Large intrusions cause a form of metamorphism called regional metamorphism.

C Igneous rocks are not affected by metamorphism because they are already crystalline.

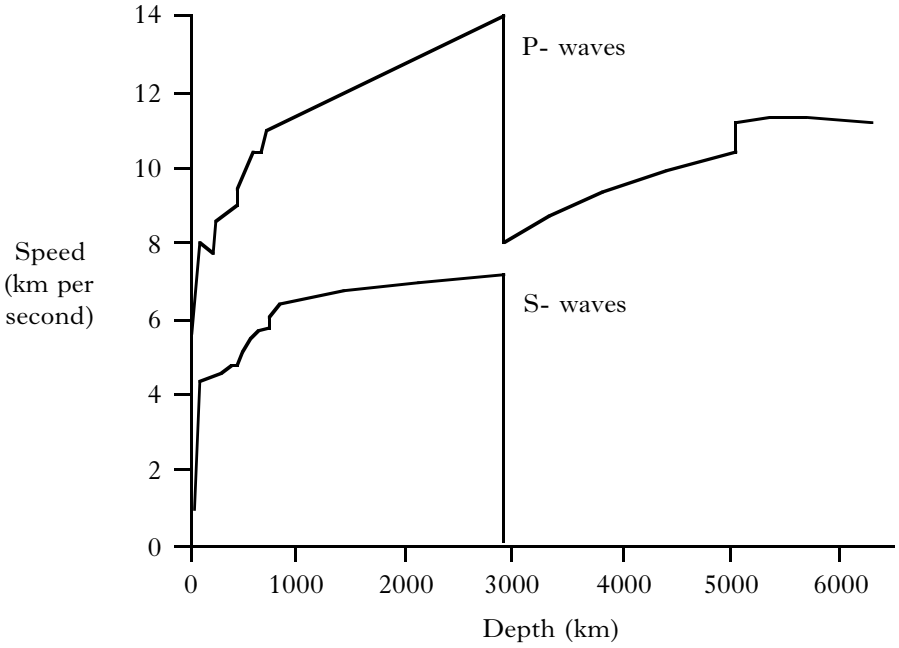
D Mylonite is commonly formed by the thermal metamorphism of volcanic ash.

Give only the letter: ..... **(1)**

Marks

5. Figure Q5 shows how P- and S- wave speeds change with depth into the Earth.

Figure Q5



(*a*) (i) Explain why the speeds of P- and S- waves decrease between the depths of 50 and 250 km.

.....

..... **(1)**

(ii) Explain why the speed of S- waves falls to zero at a depth of 2900 km.

.....

..... **(1)**

(iii) Explain why the speed of P- waves increases at a depth of 5150 km.

.....

..... **(1)**

Marks

5. (continued)

Table Q5 gives the speeds of P- waves as they pass through different materials.

Table Q5

Material	*P- wave speed (km per second)*
air	0·34
water	1·5
quartz	6·0
feldspar	6·7
pyroxene	7·3
olivine	8·5
sandstone	3·0

(*b*) The sandstone is made up of quartz grains. Give **one** reason to explain why P- waves travel more slowly through the sandstone than through quartz.

.....

..... **(1)**

(*c*) From Table Q5, give **one** reason to explain why P- waves travel faster in the mantle than in the crust.

.....

.....

..... **(1)**

(*d*) How fast would you expect P- waves to travel in granite?
Give a reason for your answer.

Speed: .....

Reason: .....

..... **(2)**

Marks

5. (continued)

(*e*) The magnitude of an earthquake is a measure of the amount of energy released. Every time the magnitude scale increases by one, the amount of energy given off increases by 30 times. (For example, an earthquake of magnitude 6 gives off 30 times as much energy as an earthquake of magnitude 5.)

How much more energy was given off by the magnitude 5 earthquake at Assissi, Italy in October 1997 than by the magnitude 2 earthquake on the Ochil Fault, Clackmannanshire in April 1998?

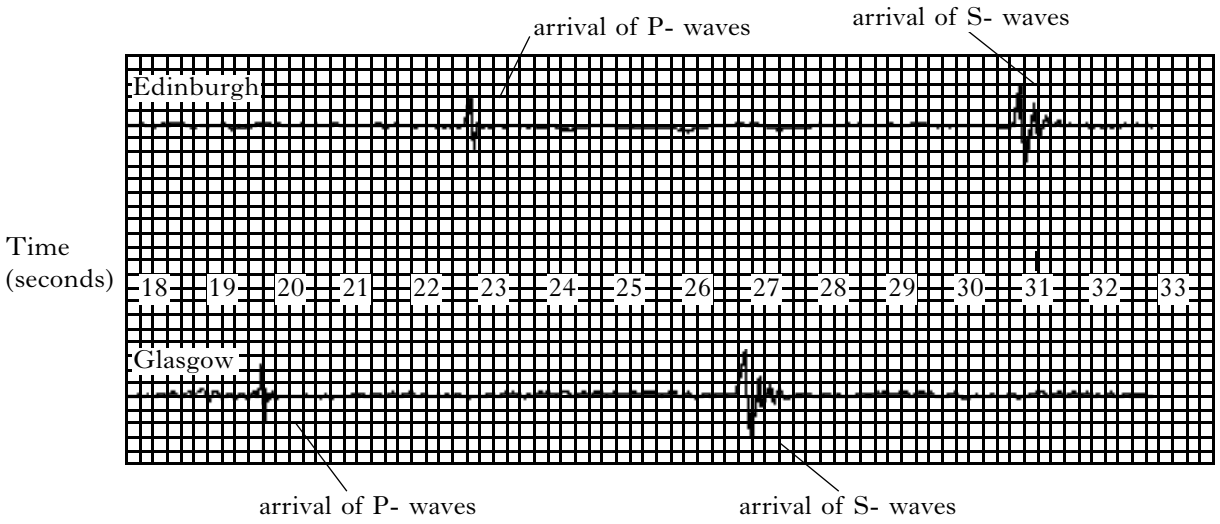
..... **(1)**

Space for working

Marks

6. Figure Q6 shows seismograms recorded at Edinburgh and Glasgow for an earthquake which took place in Scotland.

Figure Q6



(*a*) (i) What is the time interval between the arrival of the P- and S- waves at Edinburgh?

..... **(1)**

(ii) What is the time interval between the arrival of the P- and S- waves at Glasgow?

..... **(1)**

(*b*) Use this equation to find the distances between the seismometers and the epicentre of the earthquake:

$$\text{distance (km)} = \text{time interval between arrival of P- and S- waves (seconds)} \times 8{\cdot}5$$

Distance between Edinburgh and epicentre : .....

Distance between Glasgow and epicentre : ..... **(1)**

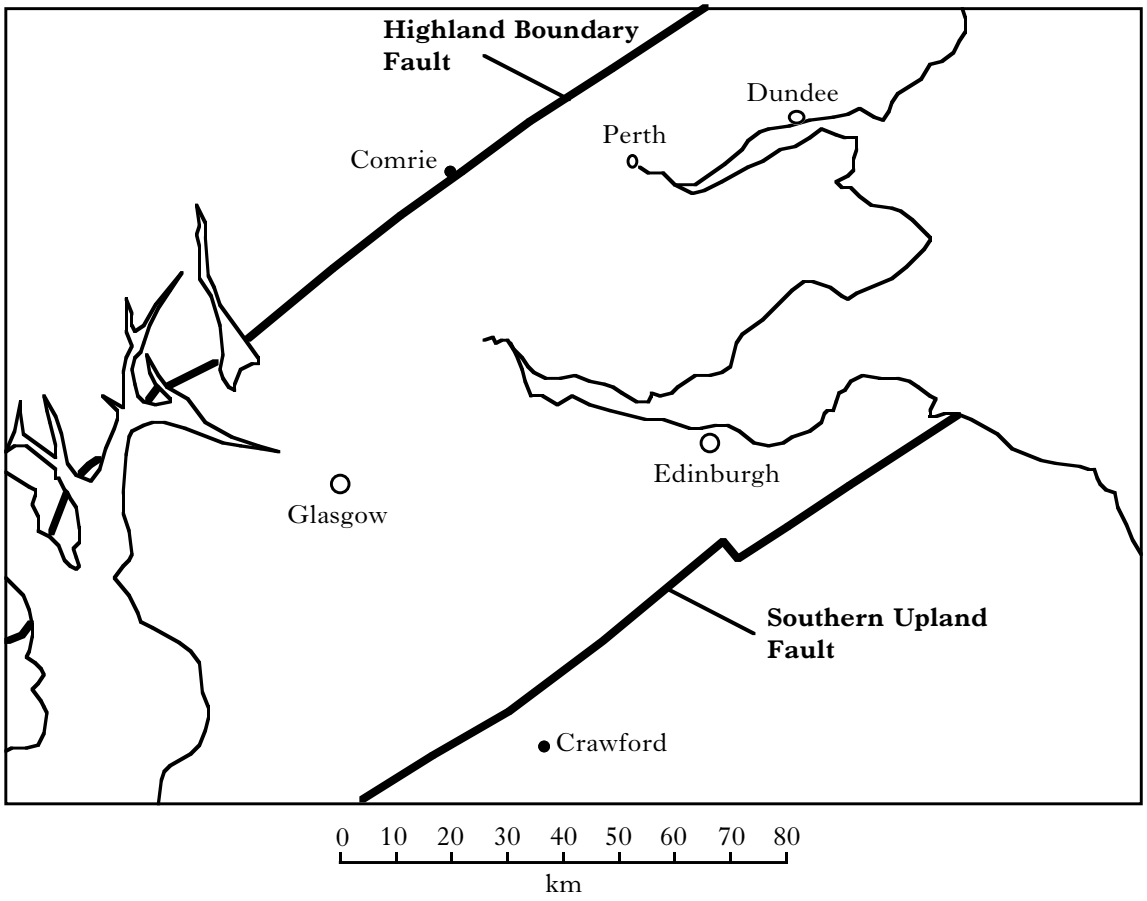
Space for working

6. (continued)

Marks

(*c*) (i) On the map provided (Figure Q6(*c*)), draw circles centred on Edinburgh and Glasgow which have radii equal to the distances between the cities and the epicentre of the earthquake.

Figure Q6(*c*)



(1)

(ii) Which **two** towns are possible positions for the epicentre?

..... **(1)**

(iii) Which town would you choose as the more likely for the position of the epicentre? Give a reason for your answer.

Town: .....

Reason: .....

..... **(1½)**

(iv) How could you find out the actual position of the epicentre?

.....

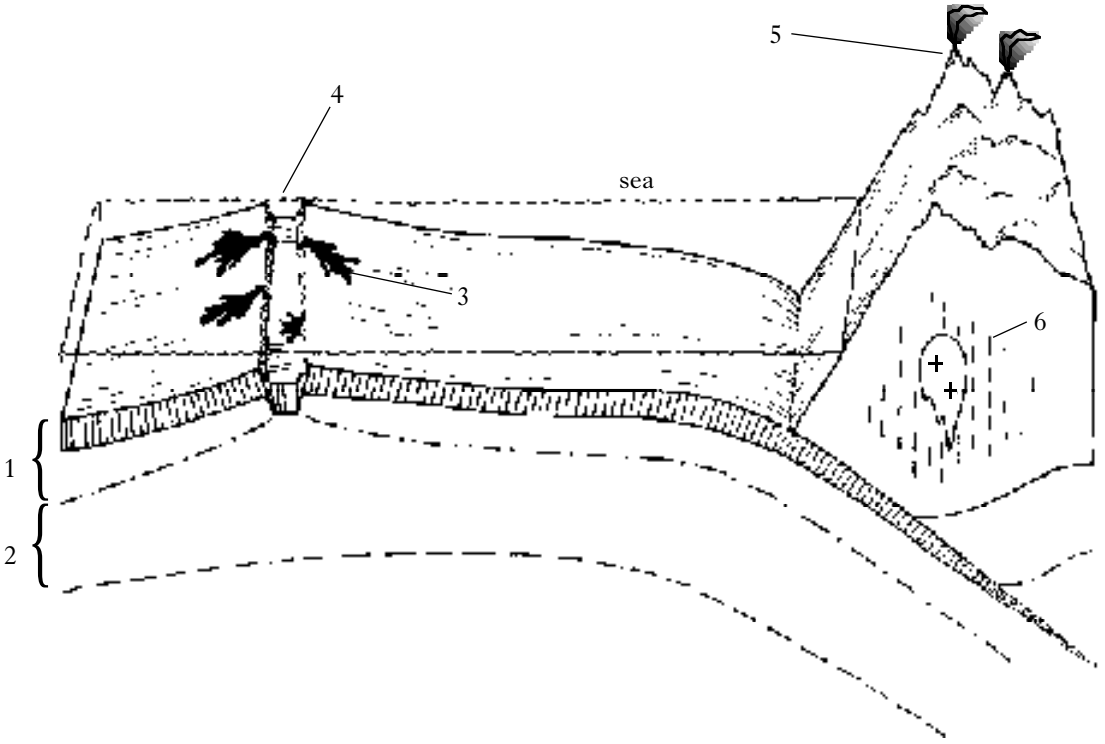
.....

..... **(2)**

Marks

7.

Figure Q7



(*a*) Use the following to complete Table Q7 to name the labelled features on Figure Q7.

Constructive plate margin

Effusive volcanic activity

Area of regional metamorphism

Lithosphere

Asthenosphere

Central vent volcanic activity

Table Q7

Labelled feature	*Name of feature*
1	
2	
3	
4	
5	
6	

(3)

(*b*) How many plates are shown on the diagram Figure Q7?

.....

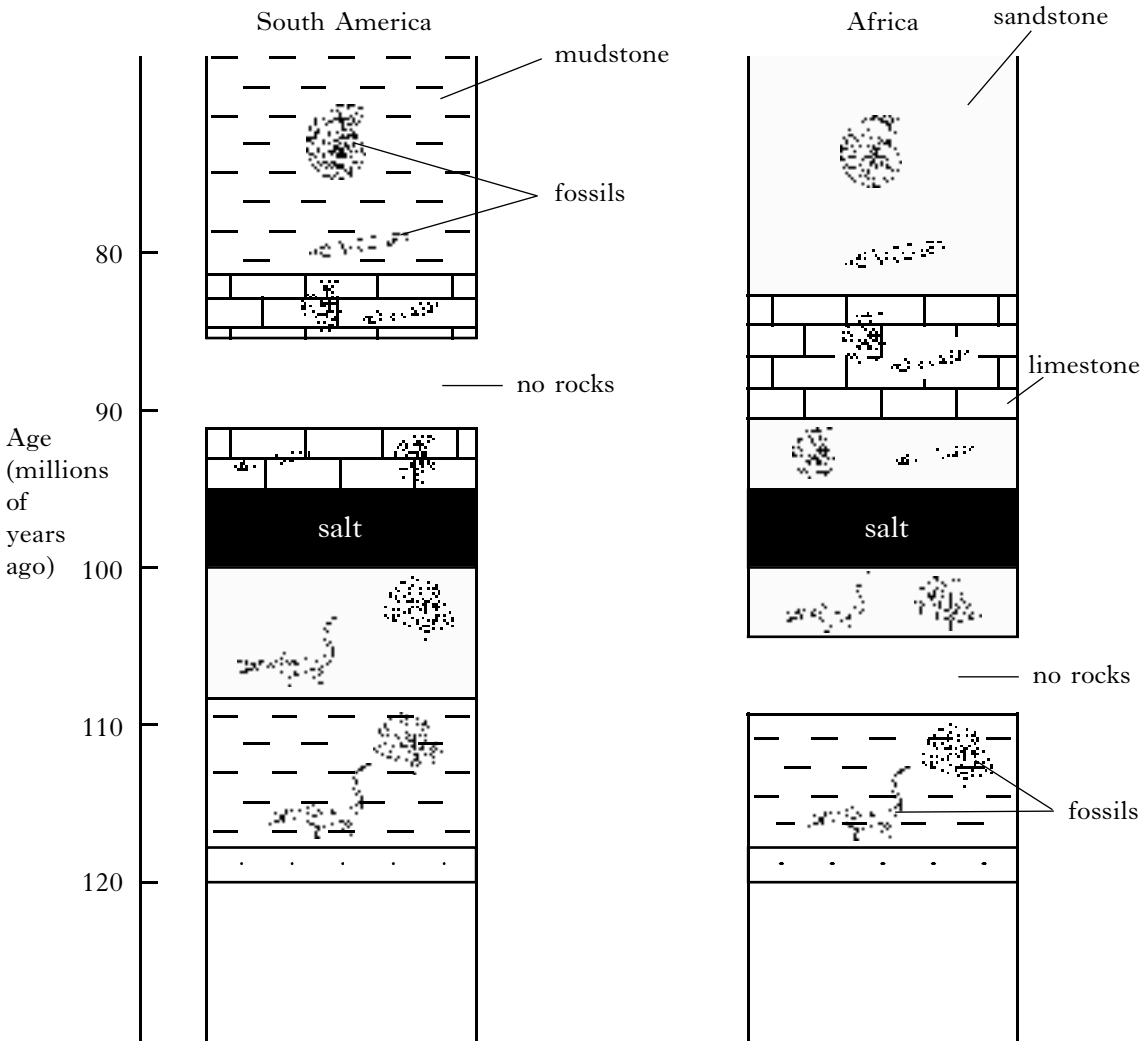
(1)

Marks

7. (continued)

(*c*) Figure Q7(*c*) shows sequences of sedimentary rocks found on the Atlantic margins of South America and Africa.

Figure Q7(*c*)



When did the continents move apart?

Give **two** reasons for your answer.

Time of separation: .....

Reason 1 .....

.....

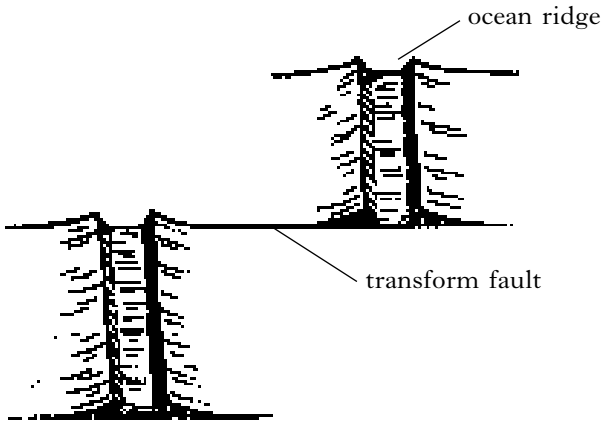
Reason 2 .....

..... **(3)**

Marks

8.

Figure Q8(*a*)



(*a*) On Figure Q8(*a*), use arrows to show the movement direction on each side of the transform fault. **(1)**

(*b*) Use diagrams to explain why magnetic stripe anomalies are symmetrical about oceanic ridges.

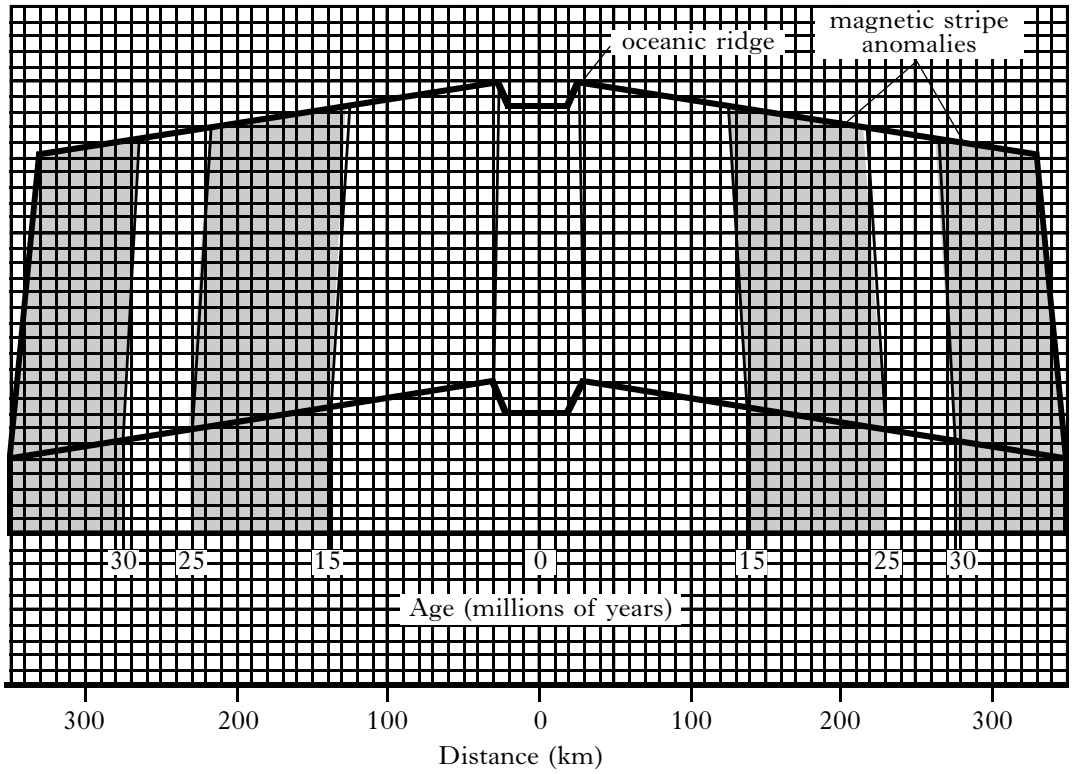
(2½)

8. (continued)

(*c*)

Marks

Figure Q8(*c*)



Calculate the rate of sea-floor spreading (in km per million years) from the oceanic ridge shown in Figure Q8(*c*).

..... **(2)**

Space for working

Candidates must not write in this margin

Marks

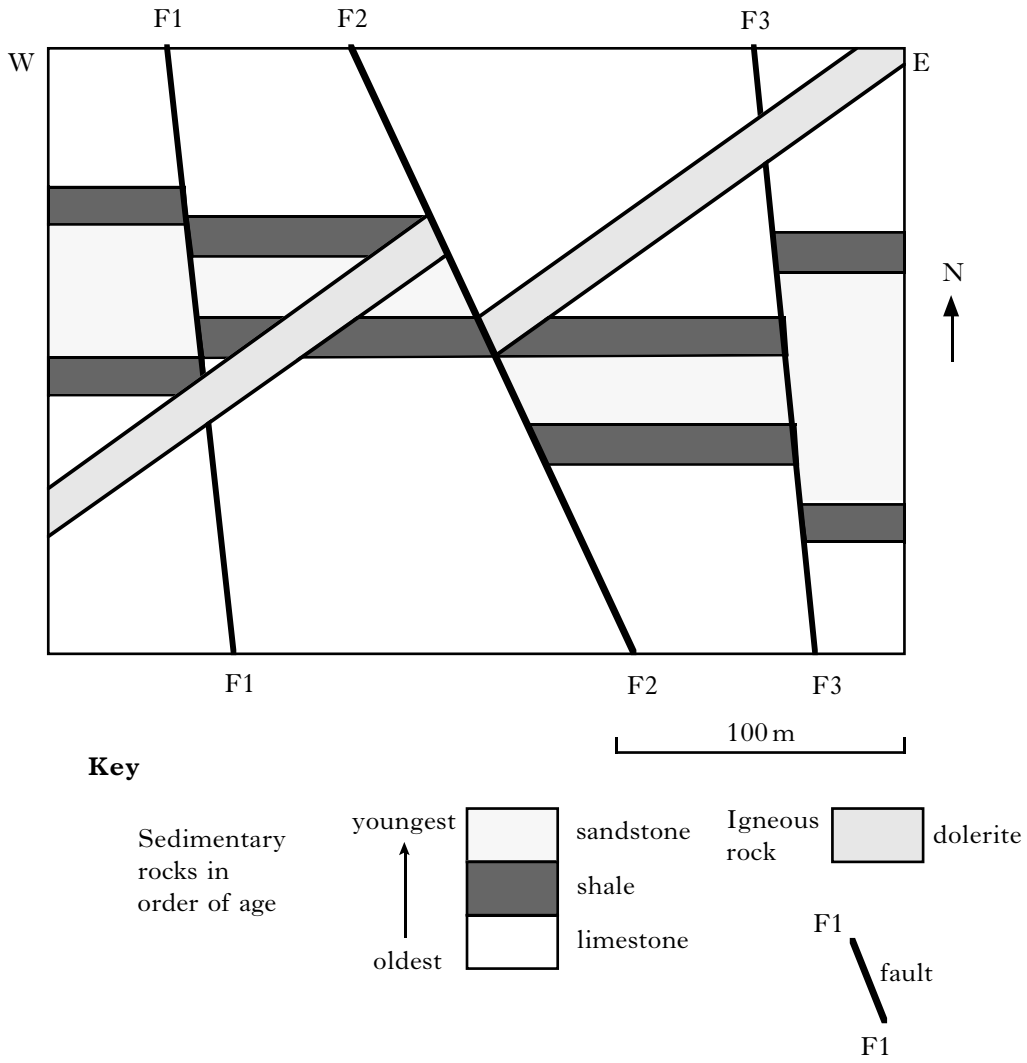
9. Use diagrams to explain how an atoll is formed.

(3)

Marks

10. Study the geological map Figure Q10.

Figure Q10



(*a*) Describe the movement directions on faults F1, F2 and F3.

Movement on F1: .....

.....

Movement on F2: .....

.....

Movement on F3: .....

..... **(3)**

10. (continued)

Marks

(*b*) Which statement is correct?

A The faults are all of the same age.

B Fault F2 is younger than Fault F3.

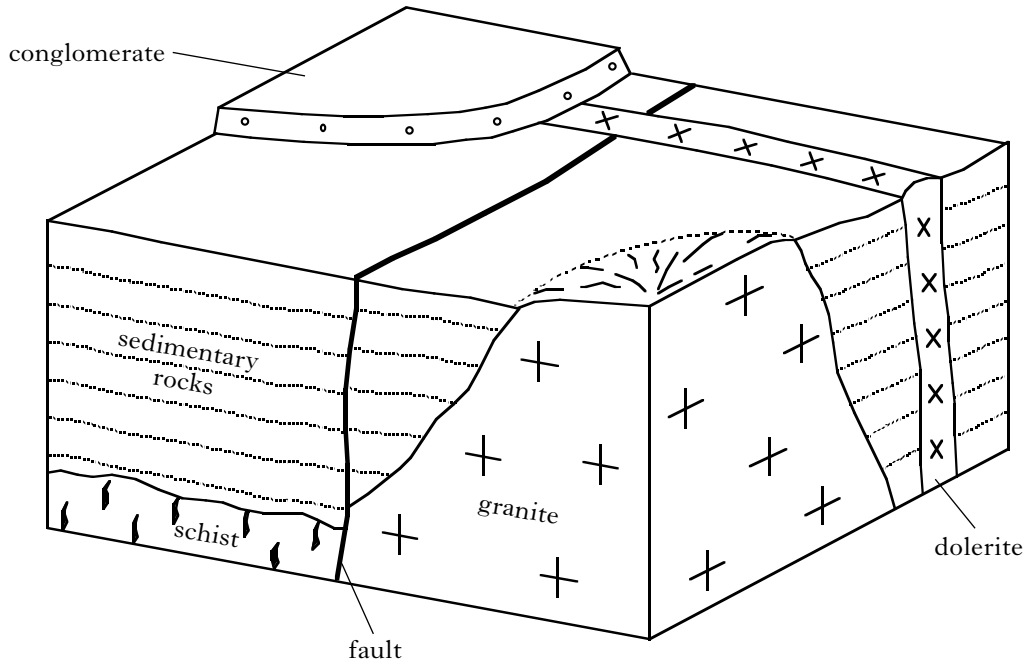
C Fault F2 is older than Fault F1.

D Fault F1 is younger than Fault F3.

Give only the letter: ..... **(1)**

(*c*) Study the block diagram, Figure Q10(*c*).

Figure Q10(*c*)



Place the following events in order from oldest to youngest.

A Movement on the fault

B Deposition of conglomerate

C Intrusion of granite

D Formation of schist

E Intrusion of dolerite

Give only the letters:

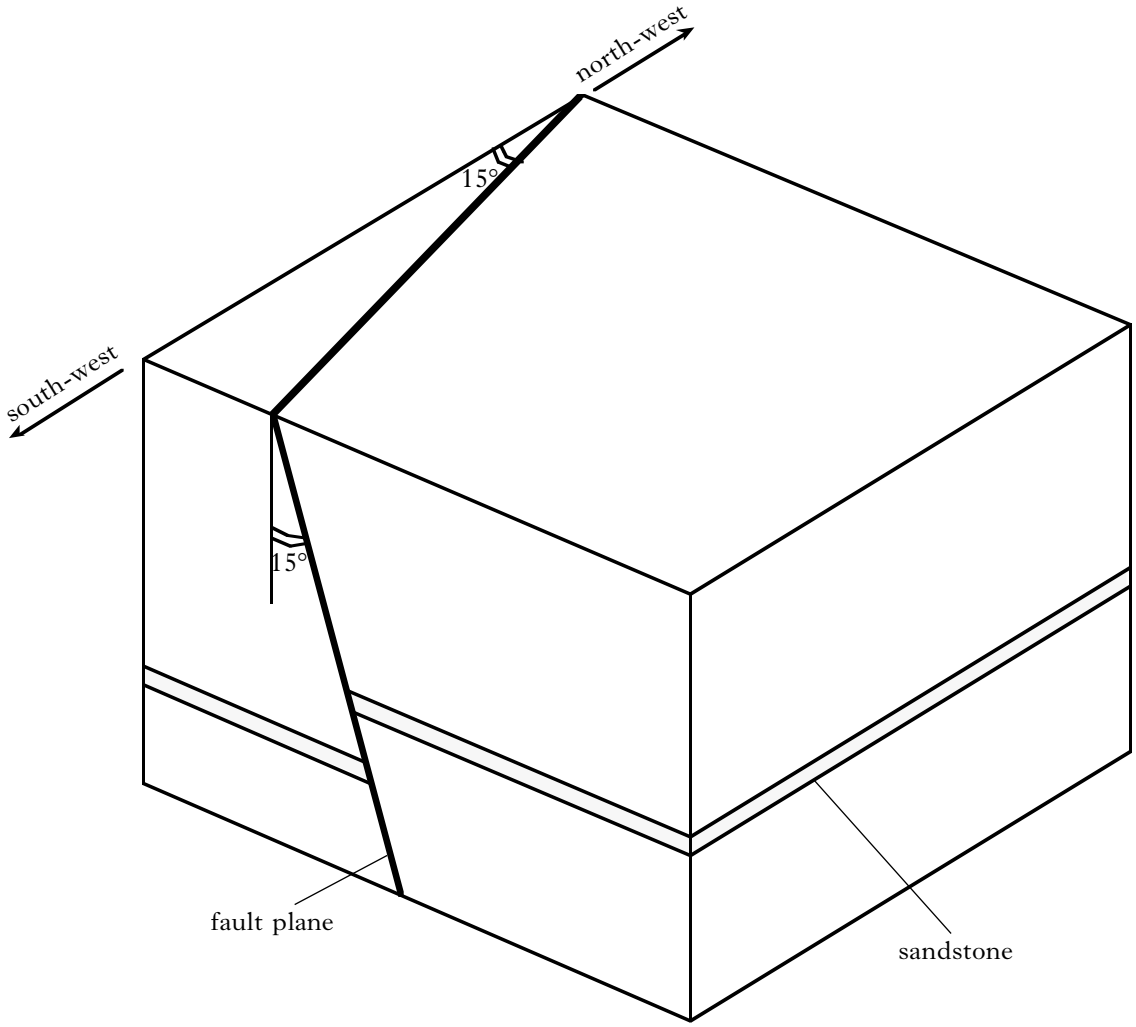
..... → ..... → ..... → ..... → .....

oldest youngest **(2$\frac{1}{2}$)**

Marks

11. Study Figure Q11.

Figure Q11



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

..... **(1)**

(ii) What is the angle and direction of dip of the fault plane?

Angle of dip: .....

Direction of dip: ..... **(2)**

(*b*) (i) What type of fault is shown on Figure Q11?

..... **(1)**

(ii) Describe the forces which formed this fault.

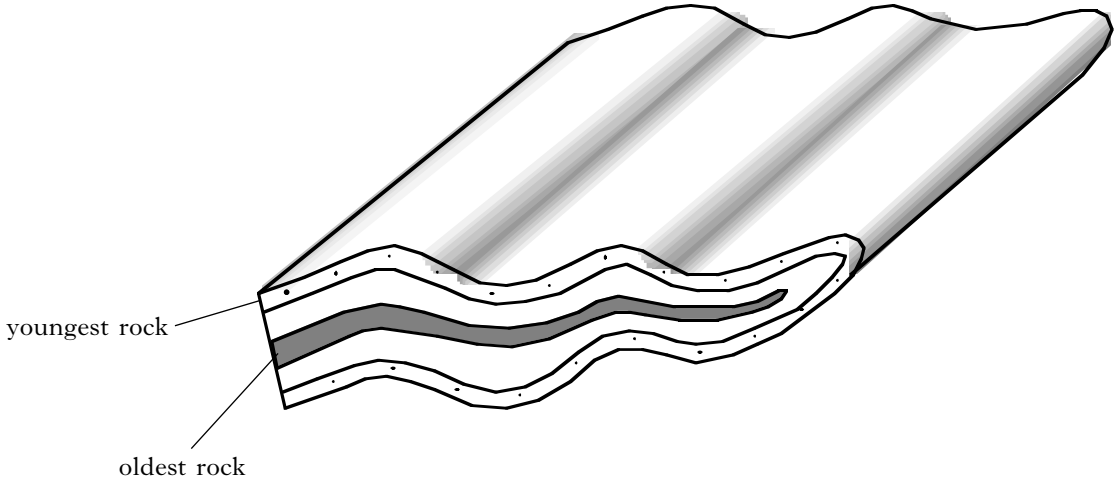
.....

..... **(1)**

Marks

11. (continued)

Figure Q11(*c*)



(*c*) Which statement correctly describes the stages of folding which formed the folds shown in Figure Q11(*c*)?

A Folding to form a syncline → folding to form anticlines and synclines.

B Folding to form anticlines and synclines → folding to form a syncline and synclines.

C Folding to form an anticline → folding to form anticlines and synclines.

D Folding to form anticlines and synclines → folding to form an anticline and synclines.

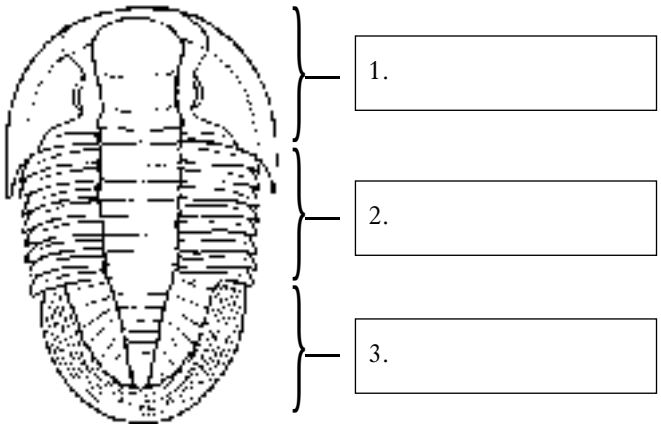
Give only the letter:..... **(1)**

Marks

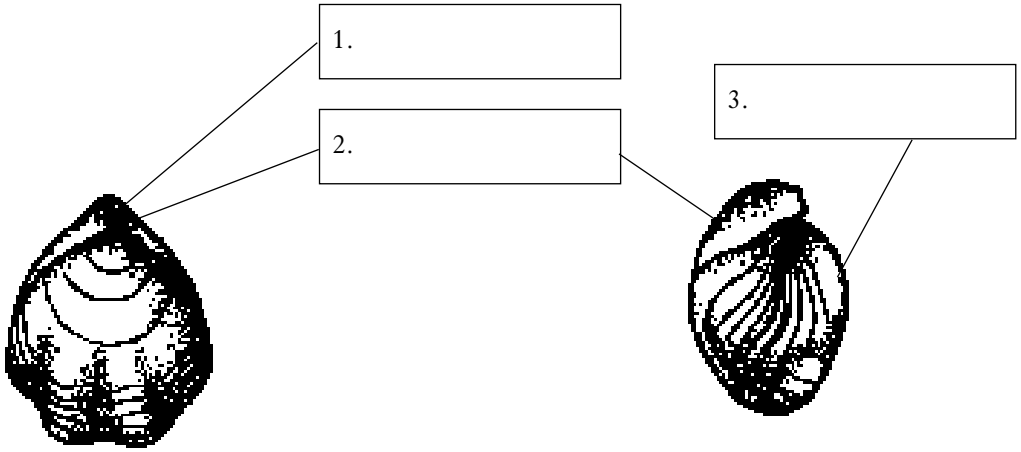
12. (*a*) Name the parts of the fossils shown in Figure Q12.

Figure Q12

Fossil P



Fossil Q



(3)

(*b*) Name fossils P and Q.

Name of fossil P: .....

Name of fossil Q: ..... **(1)**

13. Figure Q13(1) is a section through a shore.

Figure Q13(1)

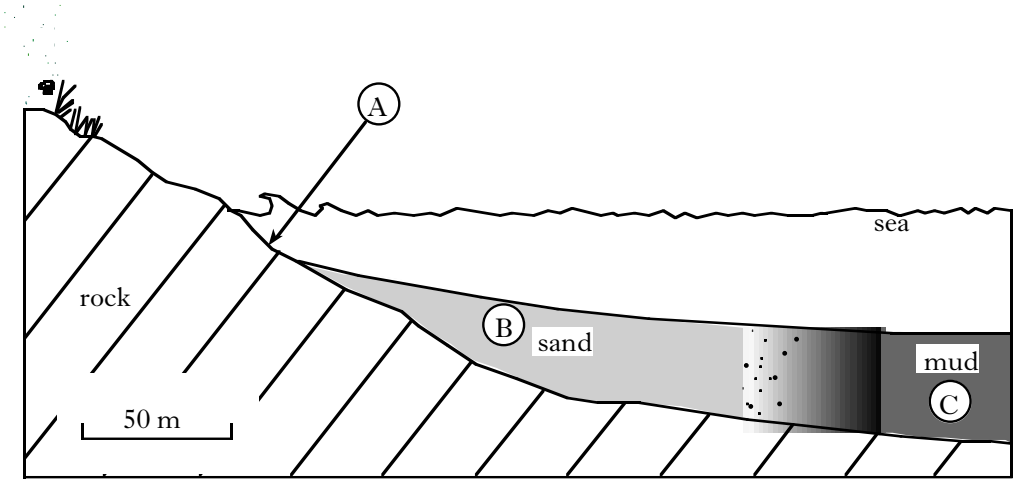
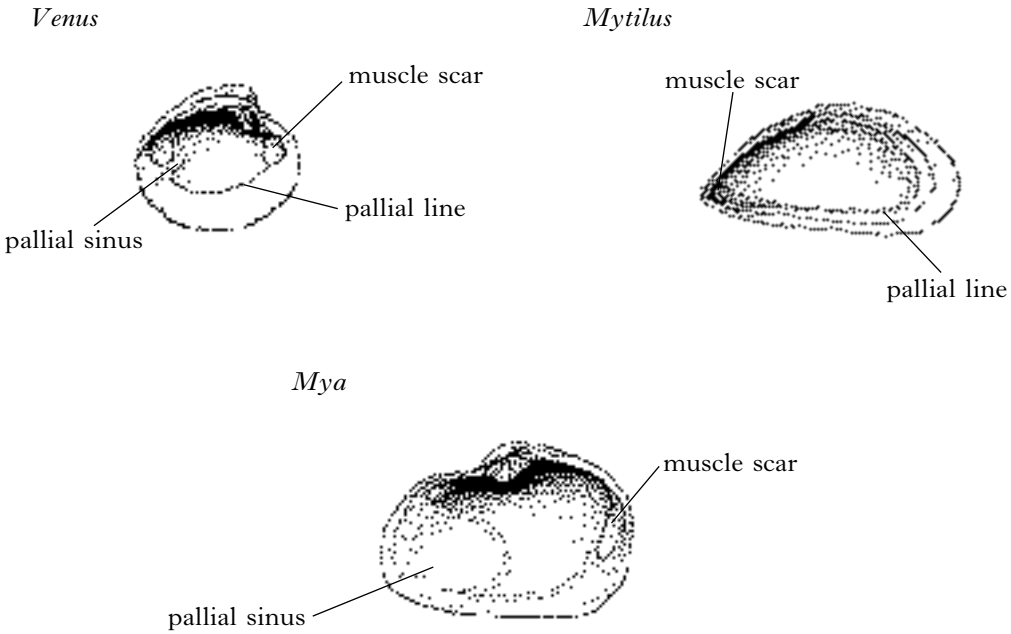


Figure Q13(2) shows bivalves which live on the shore.

Figure Q13(2)



Marks

13. (continued)

Complete Table Q13 to show the places in Figure Q13(1) where the bivalves live. Give a reason for each answer.

Table Q13

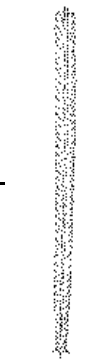
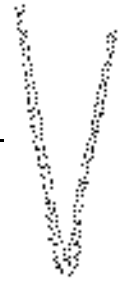
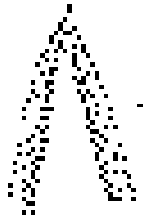
Position on Figure Q13(1)	*Name of bivalve which lives at this position*	*Reason for answer*
A		
B		
C		

(3)

Marks

14. Figure Q14 shows the distribution of four types of graptolite in Ordovician rocks.

Figure Q14

Age of rocks	*Type of graptolite*			
	Diplograptus	*Dicellograptus*	*Nemagraptus*	*Didymograptus*
Upper Ordovician				
Middle Ordovician				
Lower Ordovician				

(*a*) Give **one** reason to explain why graptolites are useful fossils for dating Ordovician rocks.

.....

..... **(1)**

(*b*) Which graptolite shown in Figure Q14 would be most useful for zoning?
Give a reason for your answer.

Name of graptolite: .....

Reason: .....

..... **(1)**

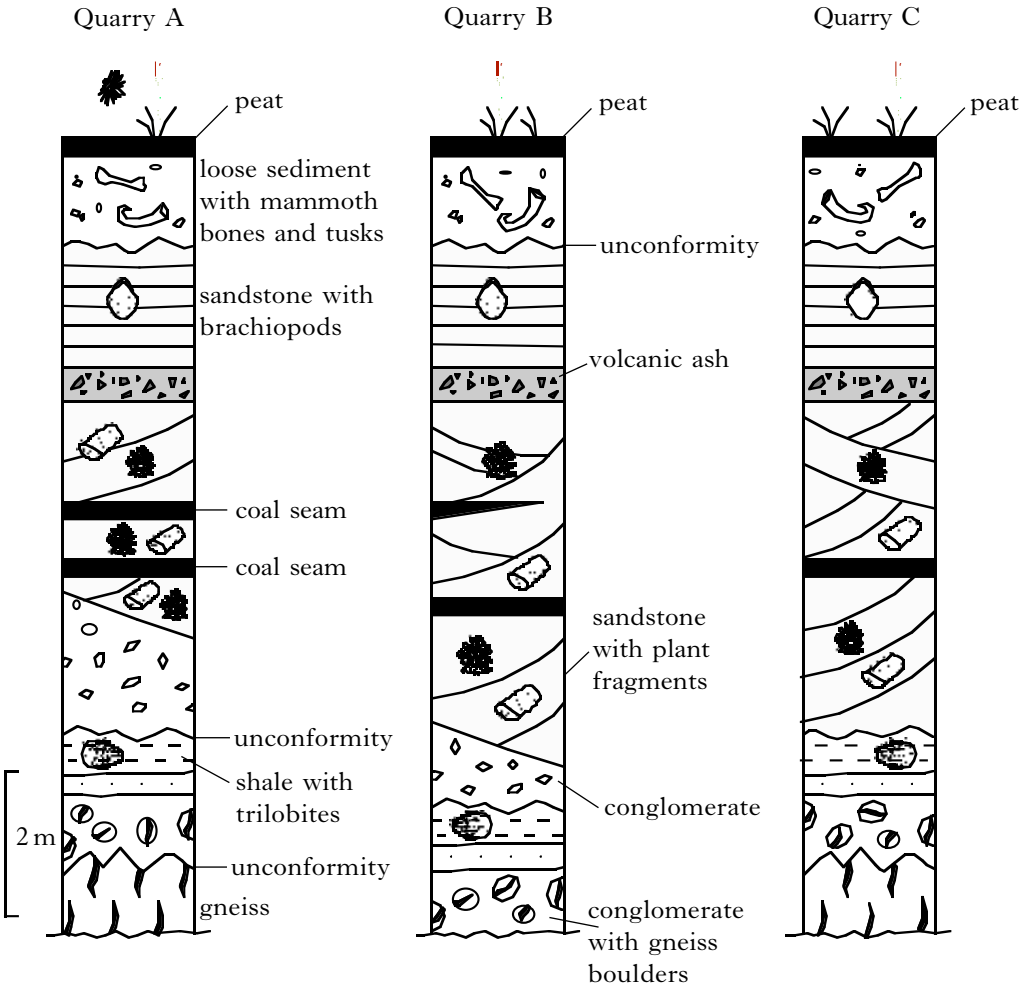
(*c*) A rock contains fossils of all of the graptolites shown in Figure Q14.
What age is the rock?

..... **(1)**

Marks

15. Figure Q15 shows rock sequences found in three quarries.

Figure Q15



(*a*) Describe the events which formed the rocks in Quarry A.

.....

.....

.....

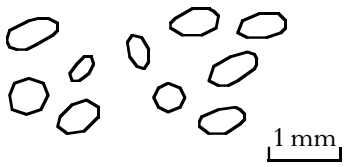
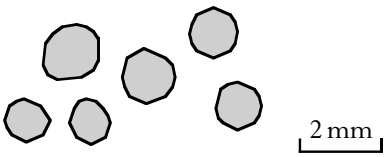
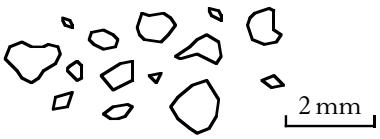
..... **(4)**

(*b*) On Figure Q15, draw lines between the rocks in the quarries to match up the sequences. **(3)**

Marks

16. Table Q16 gives details of sand from different environments. Details of sand from an unknown environment are also given.

Table Q16

Environment	*Appearance of sand*	*Description of sand*
Beach		Grains well-rounded and polished. Grains mostly of the same size.
Desert		Grains very well-rounded and frosted. Grains mostly of the same size.
Glacial		Grains have sharp edges. There is a wide range of grain size.
Unknown		There is a mixture of grain shapes and sizes. Some grains are polished.

(*a*) Explain why the beach, desert and glacial sands have the properties described.

(i) **Beach sand**

Why the grains are well-rounded and polished: .....

.....

Why the grains are mostly of the same size: .....

..... **(2)**

Marks

16. (*a*) (continued)

(ii) **Desert sand**

Why the grains are very well-rounded and frosted: .....

.....

Why the grains are mostly of the same size: .....

..... **(2)**

(iii) **Glacial sand**

Why the grains have sharp edges: .....

.....

Why there is a wide variety of grain size: .....

..... **(2)**

(*b*) Name an environment from which the unknown sand may have come.
Give **two** reasons for your answer.

Environment: .....

Reasons:

1. .....

.....

2. .....

..... **(2$\frac{1}{2}$)**

Marks

17. Fossil gastropods of the same species were collected from a sequence of sedimentary rocks. Details of the rocks and of the fossils are shown in Table Q17.

Table Q17

Rock	*Average grain size of sedimentary rock (mm)*	*Averages of measurements on gastropods*			*Number of gastropods per cubic metre of rock*
		Height (mm)	*Width (mm)*	*Shell thickness (mm)*	
P	0·001	40·0	21·0	1·0	82
Q	0·1	36·0	20·0	1·2	120
R	3·0	30·0	18·0	2·1	8
S	10·0	24·0	16·0	2·4	4
T	40·0	no fossils found			0

(*a*) Calculate the ratios of height/width for the gastropods in Rocks P, Q, R and S.

Ratios:

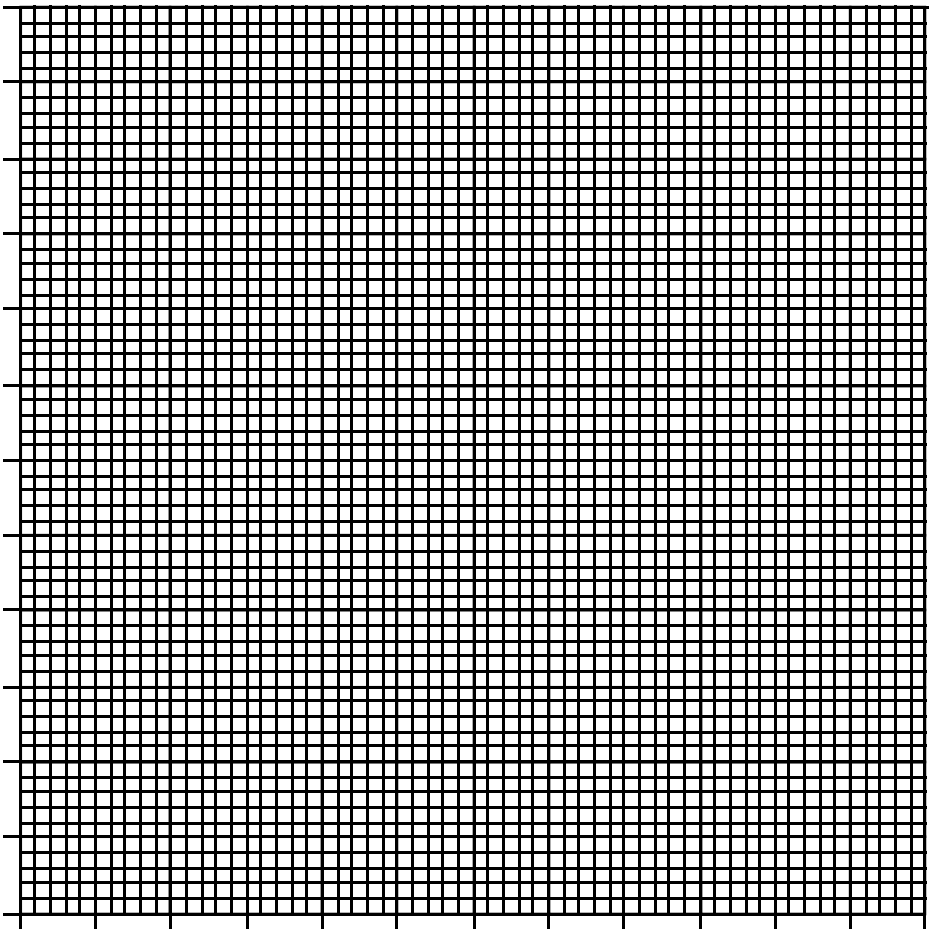
Rock P ..... Rock Q .....

Rock R ..... Rock S ..... **(2)**

Marks

16. (continued)

(*b*) (i) On the graph paper below, draw a line graph to show how the height/width ratio changes with shell thickness.



(2)

(ii) Describe the relationship shown on the graph.

.....

..... **(1)**

(*c*) (i) Describe the relationship between the shape of the shell and the strength of the currents which deposited the sediments.

.....

..... **(1)**

Candidates must not write in this margin

Marks

16. (*c*) (continued)

(ii) Describe the relationship between the thickness of the shell and the strength of the currents which deposited the sediments.

.....

..... **(1)**

(*d*) (i) Give a reason to explain why Rock T has no fossils.

.....

..... **(1)**

(ii) Give a reason to explain why Rock Q has more fossils than finer and coarser rocks.

.....

..... **(1)**

Total: 100 marks

[*END OF QUESTION PAPER*]

[C043/SQP085]

Intermediate 2 Geology

NATIONAL QUALIFICATIONS

Specimen Marking Instructions

SCOTTISH QUALIFICATIONS AUTHORITY

1. Accept any distinguishing properties, eg:

(*a*) Haematite: Red-brown streak; colour iron-grey, black or red-brown
Pyrite: Greeny-black streak; colour brassy-yellow 1 mark

(*b*) Granite: Coarse-grained; made up of quartz and feldspar
Dolerite: Medium-grained; made up of pyroxene and feldspar 1 mark

2. (*a*) 1 Made up of fragments
2 Shows bedding 2 marks

(*b*) C, F 2 marks

(*c*) Diagrams —1 mark

As a turbidity current slows the largest particles are deposited first. These are followed by progressively smaller particles—1 mark

or

As a river current slows the largest particles are deposited first. These are followed by progressively smaller particles.—1 mark

2 marks

3. (*a*) In an igneous rock, a crystal which is much larger than the main mass of crystals making up the rock. 1 mark

(*b*) Slow cooling (allowed growth of large crystals) 1 mark
followed by
Rapid cooling (which produced fine-grained matrix) 1 mark

(*c*) Basalt 1 mark

(*d*) Accept any three distinguishing features, eg:

Sill	*Lava flow*
Rocks above and below metamorphosed.	Underlying rocks metamorphosed.
Chilled margins top and bottom.	No chilled margins or chilled on lower surface only.
May be transgressive.	Not transgressive.
Top and bottom not rubbly.	Top and bottom may be rubbly or brecciated.
No fossil soil on top.	May be fossil soil on top.
No weathered surface.	Top may be weathered **before** next rock deposited or eruption of next lava flow.
Younger than rocks above and below.	Younger than rock below but older than overlying rock.

3 marks

4. (*a*) (P): marble

(S): quartzite **or** metaquartzite **or** metamorphic quartzite 1 mark

(*b*) (Q): hornfels

(R): spotted rock **or** spotted shale 2 marks

Accept any distinguishing feature, eg:

Hornfels	*Spotted rock*
No spots	Spotted
Completely crystalline	Partly crystalline
No sign of pre-existing sedimentary features	Sedimentary features (eg bedding) still evident
Breaks into splinters	Breaks into flakes
Very hard	Fairly soft

1 mark

(*c*) Accept any distinguishing feature, eg:

Rock (T)	*Rock* (U)
No foliation present	Foliation present
Minerals characteristic of thermal metamorphism (eg andalusite may be present)	Minerals characteristic of regional metamorphism (eg garnet may be present)

1 mark

(*d*) A 1 mark

5. (*a*) (i) Accept any reasonable explanation, eg:

The mantle is weak in this area.

The mantle is soft in this area.

The mantle is partly molten in this area.

The mantle in this area has a small proportion of liquid. 1 mark

(ii) Here, the waves reach the liquid outer core. S-waves cannot travel through a liquid. 1 mark

(iii) Here, the P-waves meet the solid inner core. P-waves travel more quickly in solids than in liquids. 1 mark

(*b*) Accept any reasonable explanation, eg:

There is air between the grains. The air will slow the P-waves.

There is water between the grains. The water will slow the P-waves.

The grains are separate from each other. There may be points of weakness or looseness at grain contacts which slow the P-waves. 1 mark

(*c*) The mantle consists mostly of olivine and pyroxene. P-waves travel quickly in these minerals.

The crust consists largely of quartz and feldspar. P-waves travel slowly in these minerals.

or

The mantle consists of crystalline rock. The crust has lots of sedimentary rock such as sandstone. P-waves would be expected to travel more quickly in igneous than in sedimentary rock. 1 mark

(*d*) Speed: Accept 6·1 – 6·6 km s^{-1}

Reason: Granite consists of quartz and feldspar. The speed would be expected to be between the speeds recorded in pure quartz and pure feldspar. 2 marks

(*e*) 27,000 times more. 1 mark

6. (*a*) Time interval for Edinburgh : 8 s — 1 mark
Time interval for Glasgow : 7 s — 1 mark

(*b*) Distance between Edinburgh and epicentre : 68 km
Distance between Glasgow and epicentre : 59·5 km — 1 mark

(*c*) (i) Drawing of circles — 1 mark

(ii) Comrie, Crawford — 1 mark

(iii) Comrie

It lies on the Highland Boundary Fault. Movement on the fault could have produced the earthquake.

(Crawford lies about 8 km south of the Southern Upland Fault. Since Crawford lies on an area of stable crust it is not likely that an earthquake would have an epicentre here.) — 1½ marks

(iv) Draw a circle centred on another seismometer station. The third circle would intersect the other two at the epicentre. — 2 marks

7. (*a*)
1 Lithosphere
2 Asthenosphere
3 Effusive volcanic activity
4 Constructive plate margin
5 Central vent volcanic activity
6 Area of regional metamorphism — 3 marks

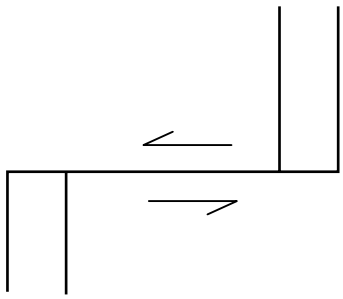
(*b*) 3 — 1 mark

(*c*) Time of separation: About 100 Ma ago

Reason 1: Salt deposits indicate onset of marine conditions. So continents separated by narrow sea.

Reason 2: The rocks older than 100 Ma old contain land and freshwater fossils. After this time the rocks contain marine fossils. — 3 marks

8. (*a*)



1 mark

(*b*) Diagrams — 1 mark
Symmetrical spreading at oceanic ridge — ½ mark
Lavas magnetised in direction of prevailing field — ½ mark
Field reversals create pattern of symmetrical magnetic anomalies — ½ mark — 2½ marks

(*c*) Spreading: 230 km in 25 Ma = 9·2 km Ma^{-1} — 2 marks

9. Diagrams: $1\frac{1}{2}$ marks

Volcano erupted onto sea floor builds up to form an island $\frac{1}{2}$ mark

Volcano sinks $\frac{1}{2}$ mark

Coral growth keeps pace with sinking so that ring-shaped reef eventually forms $\frac{1}{2}$ mark — 3 marks

10. (*a*) F1: Down on west

F2: NE side moved horizontally to SE

F3: Down on east — 3 marks

(*b*) B — 1 mark

(*c*) D → C → A → E → B

Order not position important

4 in correct order 2 marks
3 in correct order 1 mark
2 in correct order $\frac{1}{2}$ mark — $2\frac{1}{2}$ marks

11. (*a*) (i) 30° or 210° — 1 mark

(ii) Angle of dip: 75°
Direction of dip: Towards SE (or 120°) — 2 marks

(*b*) (i) Reverse fault — 1 mark

(ii) Compressive forces (acting NW – SE) — 1 mark

(*c*) C — 1 mark

12. (*a*) Fossil P : 1 Cephalon
2 Thorax
3 Pygidium

Fossil Q: 1 Foramen
2 Pedicle valve
3 Brachial valve — 3 marks

(*b*) Fossil P: Trilobite
Fossil Q: Brachiopod — 1 mark

13. A *Mytilus* Lack of pallial sinus indicates very short siphons retained within the shell. The organism would not burrow. Rather, it would be attached to rocks.

B *Venus* The small pallial sinus indicates short siphons which would extend only a short distance outside the shell. This is indicative of a shallow burrower.

C *Mya* The large pallial sinus indicates long siphons which would extend a long way out of the shell. This is indicative of a deep burrower. — 3 marks

14. (*a*) Accept any reasonable answer, eg

1 Graptolites evolved rapidly and rapidly became extinct.
2 Each species existed for only a short time.
3 They are widespread (because they were planktonic).
4 They are common and easy to identify. 1 mark

(*b*) *Nemagraptus*

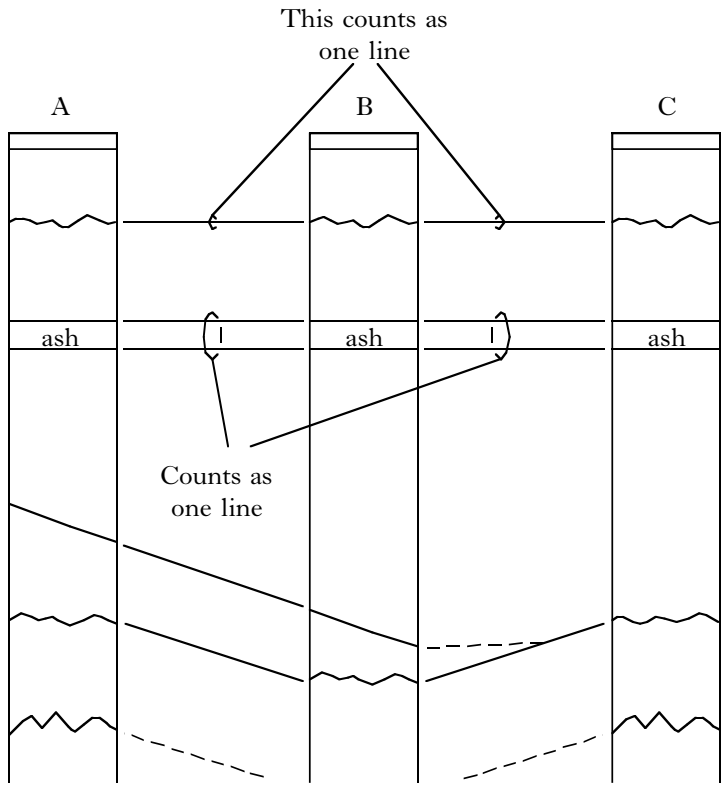
It existed for the shortest time (and so would define the narrow band of rocks). 1 mark

(*c*) Middle Ordovician 1 mark

15. (*a*) From old to young:

High grade metamorphism deep in crust forms gneiss.
Uplift, erosion and deposition of conglomerate and marine sediments.
Uplift, erosion and deposition of second conglomerate.
Deltaic deposition forms cross-bedded sandstone and coal seam.
Volcanic eruption leaves layer of ash.
Marine deposition to form sandstones.
Uplift, erosion and deposition of sediment in cold climate.
Followed by peat formation. $\frac{1}{2}$ mark each 4 marks

(*b*)



$\frac{1}{2}$ mark for each correct line 3 marks

16. (*a*) (i) Beach sand

Constant to-and-fro movement on beach

Currents on beach are of a relatively constant strength so grains of a particular size will tend to accumulate here. 2 marks

(ii) Desert sand

Grains are rolled and bounced by wind. No cushioning effect is provided by air so grains chipped to spherical shape.

Wind has a low viscosity so can transport and deposit only a narrow range of grain sizes. 2 marks

(iii) Glacial sand

The grains are crushed by the ice.

Crushing produces fragments of any size. Glacial processes do not separate the grains into different sizes. 2 marks

(*b*) Accept any reasonable answer as long as the answer is justified, eg

Environment: River

Reasons: 1 The polish on some grains indicates water transport.

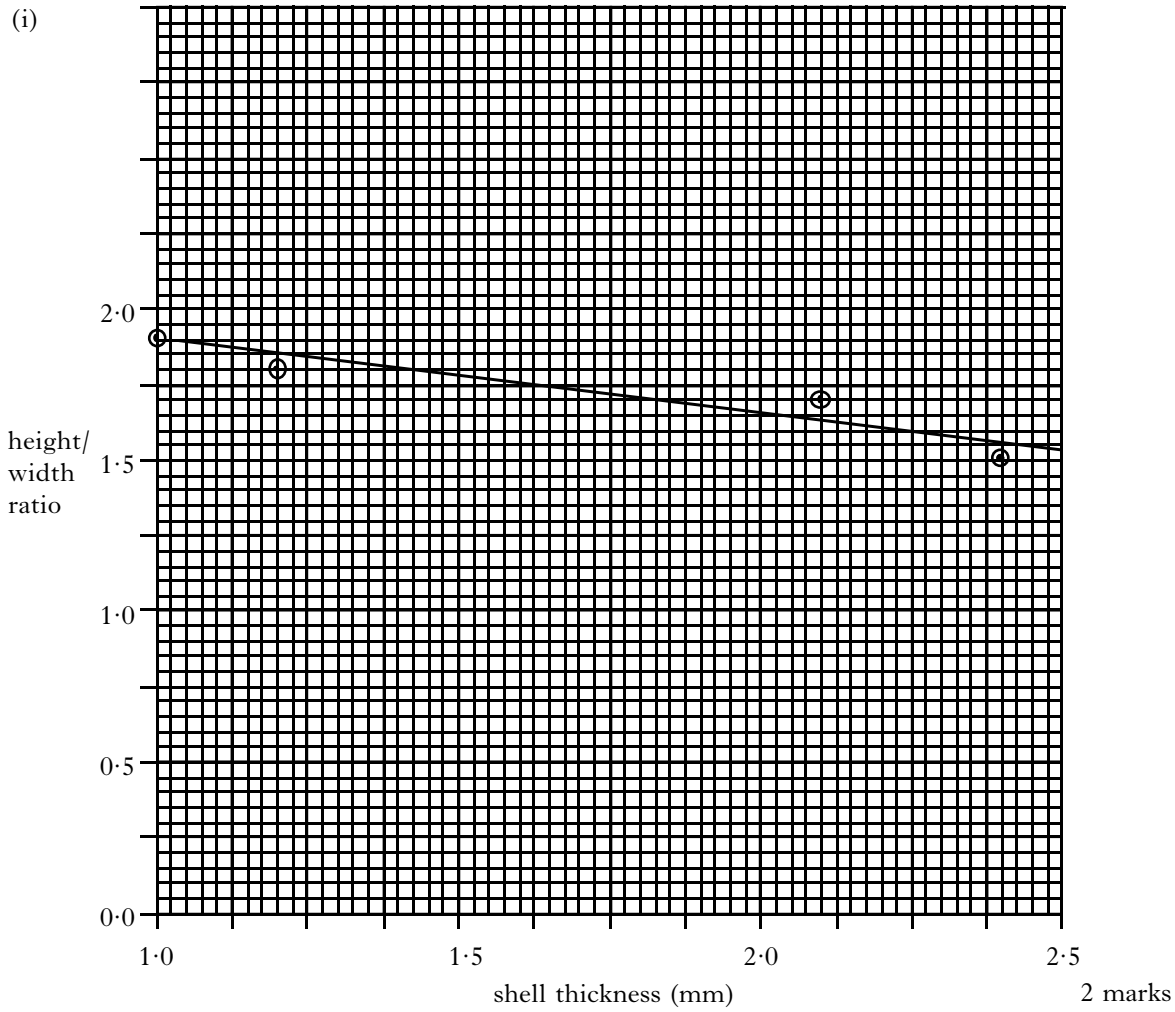
2 The variable grain sizes indicate variable current strengths which are characteristic of rivers.

3 The variable grain shapes indicate short time in transport which is characteristic of rivers. $2\frac{1}{2}$ marks

17. (*a*) P 1·9
Q 1·8
R 1·7
S 1·5

2 marks

(*b*) (i)



2 marks

(ii) As the height/width ratio decreases, the shell thickness increases. 1 mark

(*c*) (i) As the current strength increases, the shell becomes rounder (decreased length/width ratio). 1 mark

(ii) As the current strength increases, the shell becomes thicker. 1 mark

(*d*) Accept any reasonable answers, eg

(i) The very coarse grain size indicates a very high energy environment. Shells would be crushed by rolling pebbles and little food would be available. 1 mark

(ii) There may have been more food than in the coarser sediment.

There may have been more oxygen than in the finer sediment. 1 mark

[*END OF MARKING INSTRUCTIONS*]