FOR OFFICIAL USE

Total

X043/12/01

NATIONAL QUALIFICATIONS 2013

TUESDAY, 7 MAY
9.00 AM – 11.30 AM

GEOLOGY
HIGHER

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 This paper consists of three sections, A, B and C. You are advised to spend about 1 hour on Section A, half an hour on Section B and 1 hour on Section C.

2 You should attempt **all** of the questions in Sections A and C and only **one** question in Section B.

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

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

5 Additional space for answers or rough work will be found at the end of this book. If further space is required, supplementary sheets may be obtained from the Invigilator and should be inserted inside the **front** cover of this booklet. You should draw a line through anything which you do not wish the examiner to mark.

6 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.

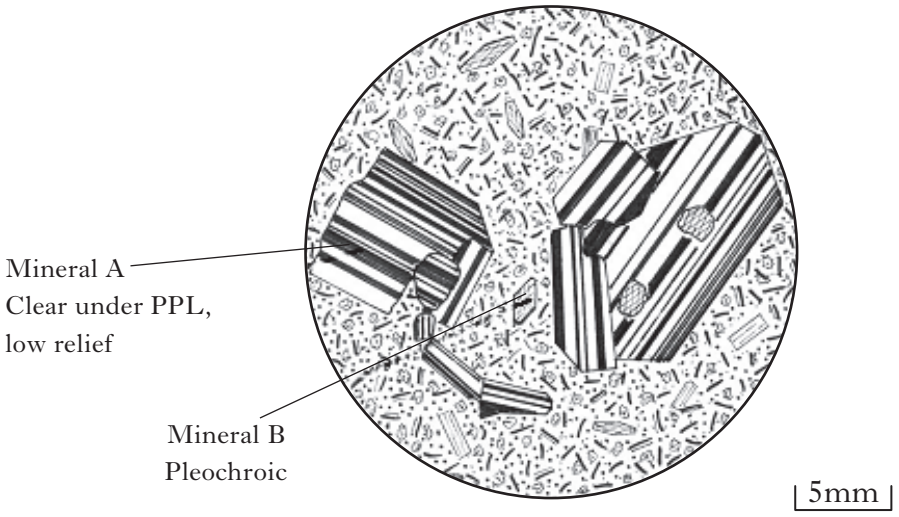
Marks

SECTION A

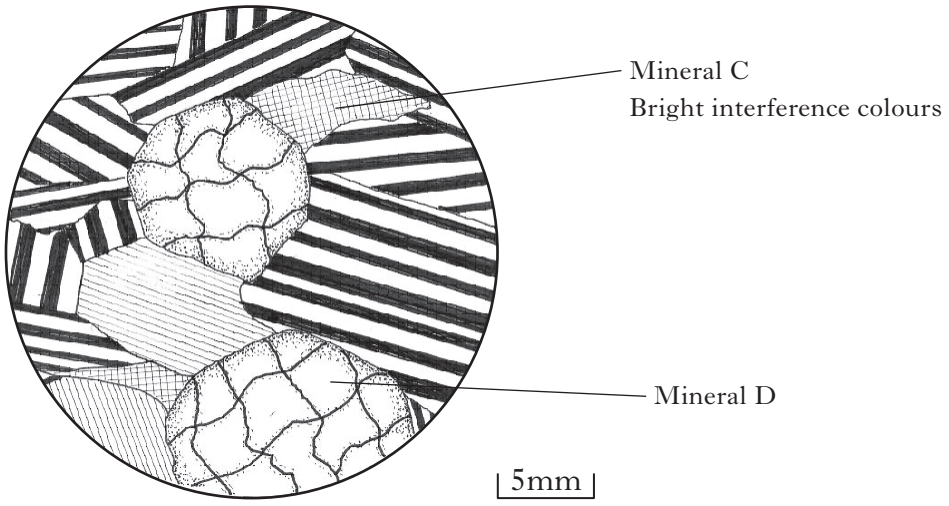
All questions in this section should be attempted. Forty marks are allocated to this section.

1. (*a*) The diagram below shows thin sections of two igneous rocks under **XPL**.

Rock 1



Rock 2



Complete the table below by naming the minerals and rocks.

Mineral or rock	*Name of mineral or rock*
Mineral A	
Mineral B	
Mineral C	
Mineral D	
Rock 1	
Rock 2	

3

DO NOT WRITE IN THIS MARGIN

Marks

1. (continued)

(*b*) What term best describes the texture of Rock 1?

..... **1**

(*c*) Describe the cooling histories of Rocks 1 and 2.

Rock 1

.....

.....

.....

.....

Rock 2

.....

.....

.....

..... **4**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

2. Study the table below which gives information about the crystallisation temperatures and weathering potential of certain minerals.

Mineral	*Approximate Crystallisation Temperature* (°C)	*CHEMICAL WEATHERING POTENTIAL* (*the higher the number the more easily weathered the mineral*)
Olivine	1050	54
Pyroxene	1000	39
Amphibole	900	36
Ca-plagioclase	1050	25
Biotite	750	22
Na-plagioclase	700	13
Orthoclase	700	12

More easily weathered ↑

(*a*) (i) On the graph paper below plot the data for each mineral.

Weathering potential ↑

Crystallisation temperature →

2

DO NOT WRITE IN THIS MARGIN

Marks

2. (continued)

(ii) On the graph, draw a **straight** best fit line by eye. **1**

(iii) Describe the relationship shown on the graph.

.....

..... **1**

(*b*) Give **one** example of a physical weathering process and **one** example of a chemical weathering process.

Give a detailed description for each of your chosen examples. **Diagrams** may be used.

Physical weathering process .....

Description .....

.....

.....

.....

Chemical weathering process .....

Description .....

.....

.....

..... **4**

DO NOT WRITE IN THIS MARGIN

Marks

3. Study the table below which gives information about the different salts found in sea water.

Salt	*Percentage of total salts*	*Solubility*
NaCl	78·04	36
$MgCl_2$	9·21	54
$MgSO_4$	6·53	33
$CaSO_4$	3·48	0·21
KCl	2·11	35
$CaCO_3$	0·33	<0·1
$MgBr_2$	0·25	102

(*Solubility*—the higher the value the more soluble the salt)

(*a*) Calculate how many times more NaCl there is in sea water than $CaCO_3$.

Space for working

Answer ..... times **1**

(*b*) Explain why evaporite sequences generally contain less NaCl than $CaCO_3$.

.....

.....

.....

..... **1**

(*c*) Describe the environmental **and** climatic conditions in which thick evaporite sequences are formed.

.....

.....

.....

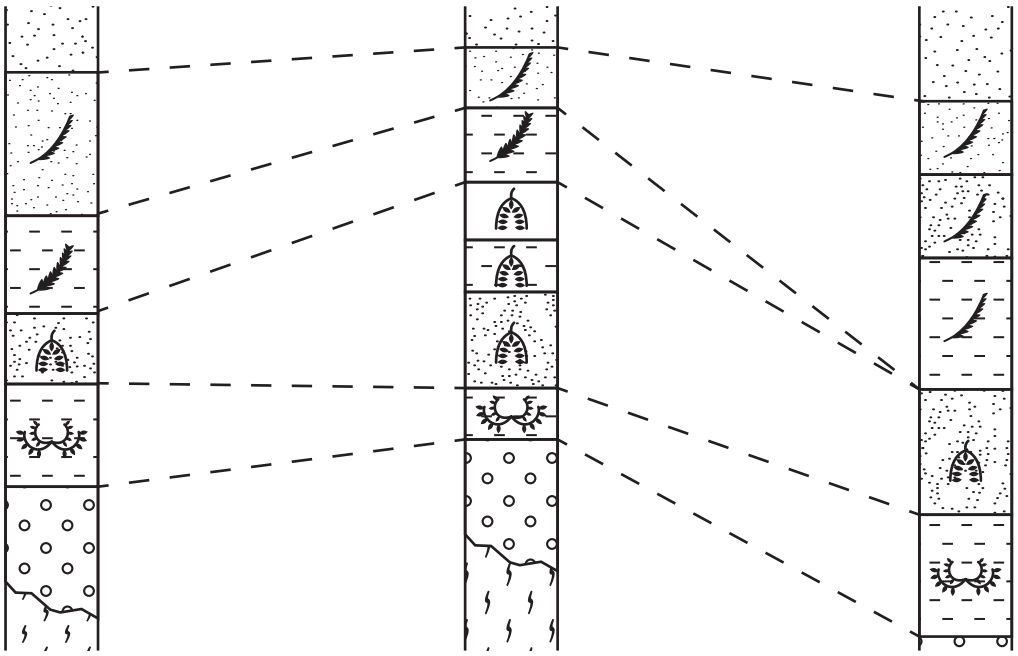
.....

..... **2**

Marks

4. Study the diagram below which shows fossil sequences in three different locations and how they correlate with each other**.**

Location 1 Location 2 Location 3



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

A Four zones are present at all three locations.
B As graptolites evolved they changed from pendant to scandent forms.
C As graptolites evolved there was an increase in the number of stipes.
D The diagram above is an example of a cyclothem.

Give only the letter **1**

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

A Good zone fossils should ideally be found all over one continent to allow worldwide correlation.
B Ammonites are so similar in form that it is difficult to distinguish one from another.
C The Jurassic Period has about sixty graptolite zones and the Silurian Period about thirty ammonite zones.
D Good zone fossils are not limited to one facies.

Give only the letter **1**

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

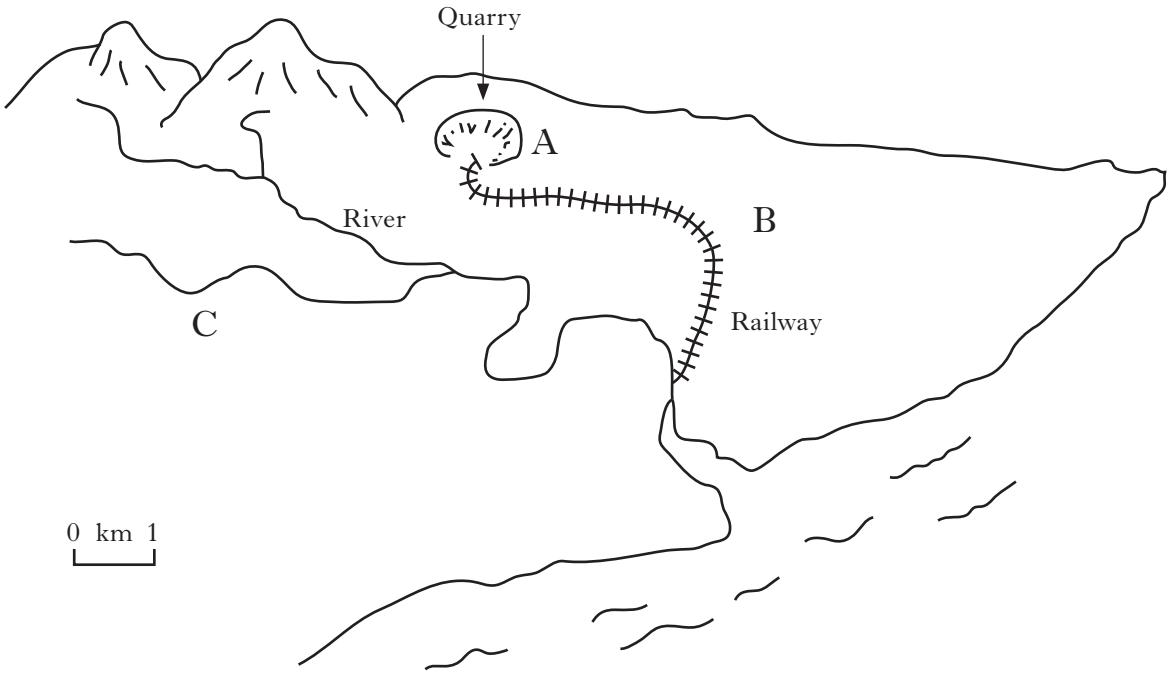
A Eras and Periods have fixed lengths.
B A system is all the rocks formed during an era.
C The majority of the rocks in Scotland are of Mesozoic age.
D Fossil forms allow relative dating.

Give only the letter **1**

DO NOT WRITE IN THIS MARGIN

Marks

5. Study the diagram below.



Iron has a crustal abundance of 7·1% and must be concentrated by a factor of 7·7 to make it worth mining. The iron ore found at Quarry A contains 60% iron.

(*a*) Calculate the cut off grade for iron and state whether it is profitable or not to mine the iron ore at A.

Space for working

Answer ..... . %

.....

.....

..... **2**

(*b*) Mercury is found at B. The cut off grade for mercury is 0·2% and its crustal abundance is 0·000008%. Calculate the factor by which mercury must be concentrated to make it worth mining.

Space for working

Answer **1**

DO NOT WRITE IN THIS MARGIN

Marks

5. (continued)

(*c*) Give **two** reasons why the cut off grade can change over time.

1 .....

2 ..... **2**

(*d*) Label the diagram with a letter "P" to show where a placer deposit would be likely to occur. **1**

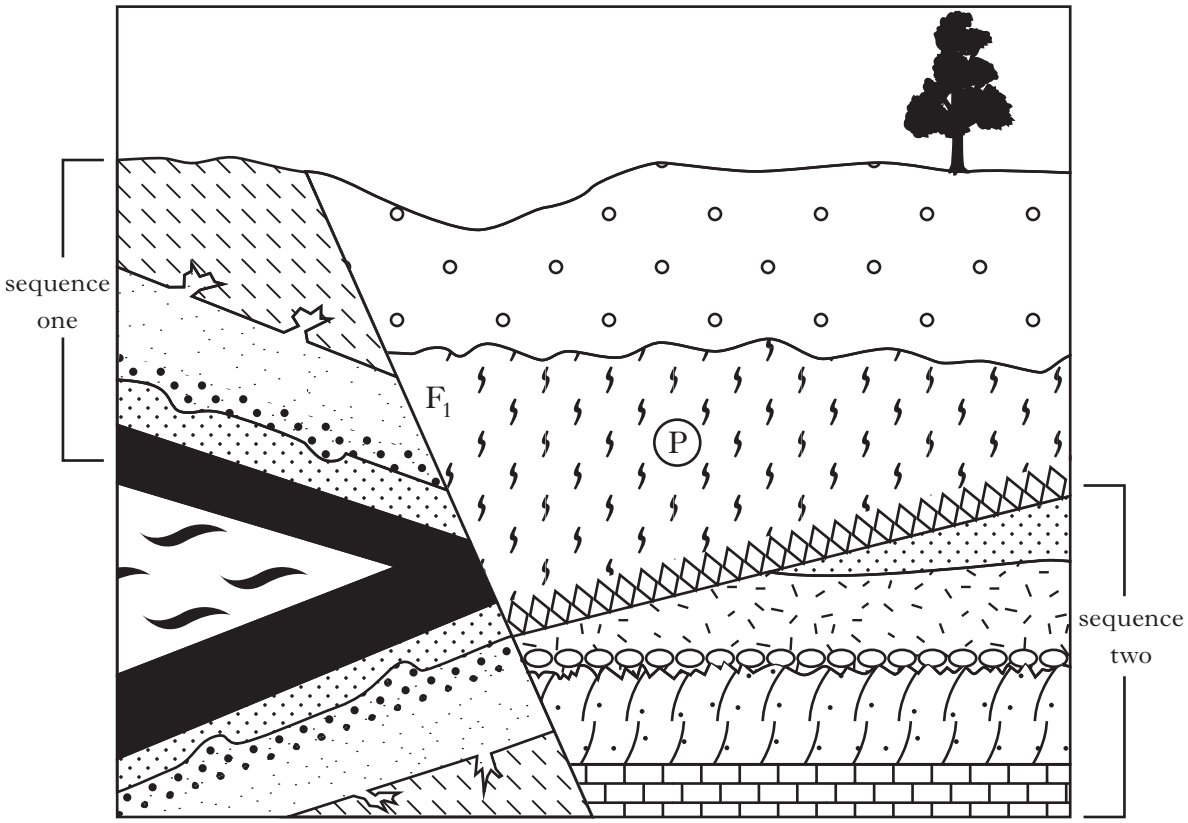
(*e*) River gravels are found at C. Explain why gravel has a low place value.

.....

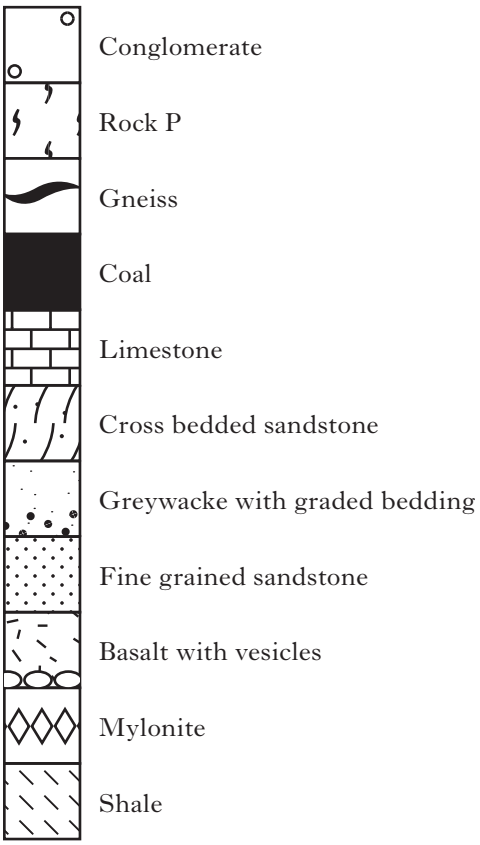
..... **1**

[Turn over

6. Examine the sketch of a quarry face below.



Rocks not in order of age



DO NOT WRITE IN THIS MARGIN

Marks

6. (continued)

(*a*) Choose the correct statement.

A Sequence one represents a change from a terrestrial to a marine environment.
B The rocks in the quarry face to the left of F1 are an overturned syncline.
C There are only two way up criteria evident in the rocks of the quarry face.
D The beds in sequence two are the right way up.

Give only the letter **1**

(*b*) Rock P and the gneiss have been analysed. Complete the table below to give their ages.

	Decay scheme	*Half Life* (*millions of years*)	*Number of parent isotope atoms*	*Number of daughter isotope atoms*	*Age* (*millions of years*)
Rock P	Uranium 238 —Lead 207	710	16	240	
Gneiss	Rubidium 87 —Strontium 87	50 000	248	8	

Space for working

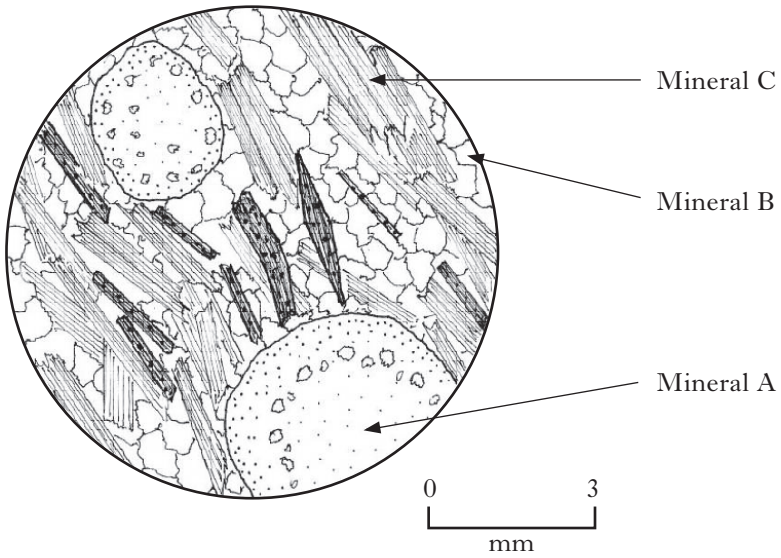
2

[Turn over

Marks

6. (continued)

(*c*) Examine the thin section of rock P below. (Shown in PPL)



(i) Identify minerals

A .....

B .....

C .....

Name the rock **4**

(ii) What term describes the texture of rock P?

..... **1**

(iii) Explain how this alignment of platy minerals can develop in a metamorphic rock (**diagrams** may be used).

.....

.....

.....

..... **2**

Section A: Total (40) marks

DO NOT WRITE IN THIS MARGIN

Marks

SECTION B

This section consists of three questions. Only ONE question should be attempted. Fifteen marks are allocated to this section.

Candidates should write their answer on pages 14, 15, 16 and 17.

Additional space for answers may be found at the end of this book.

7. Write an essay on volcanoes.

Credit will be given for the use of diagrams.

Give details as follows.

(*a*) Volcanic activity at destructive plate margins **5**

(*b*) Volcanic activity at constructive plate margins **4**

(*c*) Caldera formation **3**

(*d*) Methods of predicting eruptions **3**

(15)

8. Write an essay on mineral identification.

Credit will be given for the use of sketches and diagrams.

Give details as follows.

(*a*) How minerals are identified in hand specimen **8**

(*b*) The optical properties of minerals in thin section **7**

(15)

9. Write an essay on the structures found in rocks.

Labelled diagrams must be used.

Give details as follows.

(*a*) How different types of faults are formed **6**

(*b*) Different types of fold **6**

(*c*) Jointing in rocks **3**

(15)

Section B: Total (15) marks

NOW GO TO SECTION C ON PAGE EIGHTEEN

DO NOT WRITE IN THIS MARGIN

SPACE FOR ANSWERS

DO NOT WRITE IN THIS MARGIN

SPACE FOR ANSWERS

DO NOT WRITE IN THIS MARGIN

SPACE FOR ANSWERS

DO NOT WRITE IN THIS MARGIN

SPACE FOR ANSWERS

Marks

SECTION C

All questions in this section should be attempted. Forty marks are allocated to this section.

10. Examine the photograph below of a quarry face.

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

A The photograph above is a good example of graded bedding.

B The photograph above is a good example of convolute bedding.

C The photograph above is a good example of cross bedding.

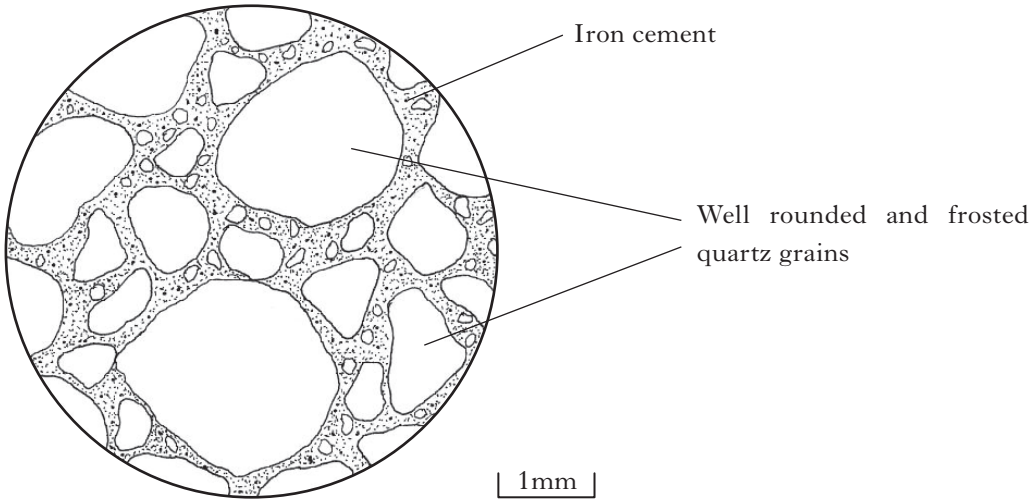
D Bedding on this scale is often associated with a river environment.

Give only the letter **1**

Marks

10. (continued)

(*b*) The thin section below was collected from the face of the quarry.



Explain why the grains of quartz are so well rounded.

.....

..... **1**

(*c*) This quarry is in Scotland. What evidence from the previous two sources (parts a and b) suggest that the rock was deposited in an environment different than is present today?

.....

..... **2**

[Turn over

DO NOT WRITE IN THIS MARGIN

Marks

11. Study the map (on the **separate worksheet**) and answer the questions based on it.

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

..... **1**

(ii) Give a reason for your answer.

Reason .....

..... **1**

(iii) Fault F1 has moved twice. Using map evidence, explain how this can be worked out.

Reason .....

..... **1**

(iv) How far did the fault move on the second occasion?

..... metres **1**

(*b*) The basalt dyke has the same mineral composition as the dolerite dyke. Why have they been classified differently?

Reason .....

..... **1**

(*c*) The grain size of the tuff varies from coarse upwards to fine in many of the layers of this rock.

Give a possible reason.

Reason .....

..... **1**

DO NOT WRITE IN THIS MARGIN

Marks

(*d*) (i) Examine the greywacke, shale and conglomerate sequence.

Of these rock types, which is probably the oldest and which is the youngest? Give an explanation **and a diagram** for your answer.

Youngest .....

Oldest .....

Explanation .....

.....

.....

Space for diagram

3

(ii) Using labelled diagrams, explain why the shale outcrops to the north east of fault F1 vary in width.

Explanation .....

.....

.....

Space for diagram

2

(*e*) (i) On which side of fault F2 have the rocks been moved up?

..... **1**

(ii) Give a reason for your answer.

Reason .....

..... **1**

(iii) The fault plane of F2 dips north east at an angle of 75°. What type of fault is F2?

Type of fault **1**

DO NOT WRITE IN THIS MARGIN

Marks

11. (continued)

(*f*) How many unconformable relationships are shown on the map?

..... **1**

(*g*) On the topographic profile, (on the **separate worksheet**), complete the geological section between points X and Y on the map. **6**

(*h*) Place the geological events of this map area in the correct position by inserting the correct letters from the list below.

The events in this table are not in the correct order.

A	Deposition of conglomerate, greywacke and shale
B	Formation of Gneiss
C	Dolerite intrusion
D	Basalt intrusion
E	Folding
F	Fault F1
G	Fault F2
H	Volcanic vent and tuff

(Give only the letters)

YOUNGEST

H
A

OLDEST **3**

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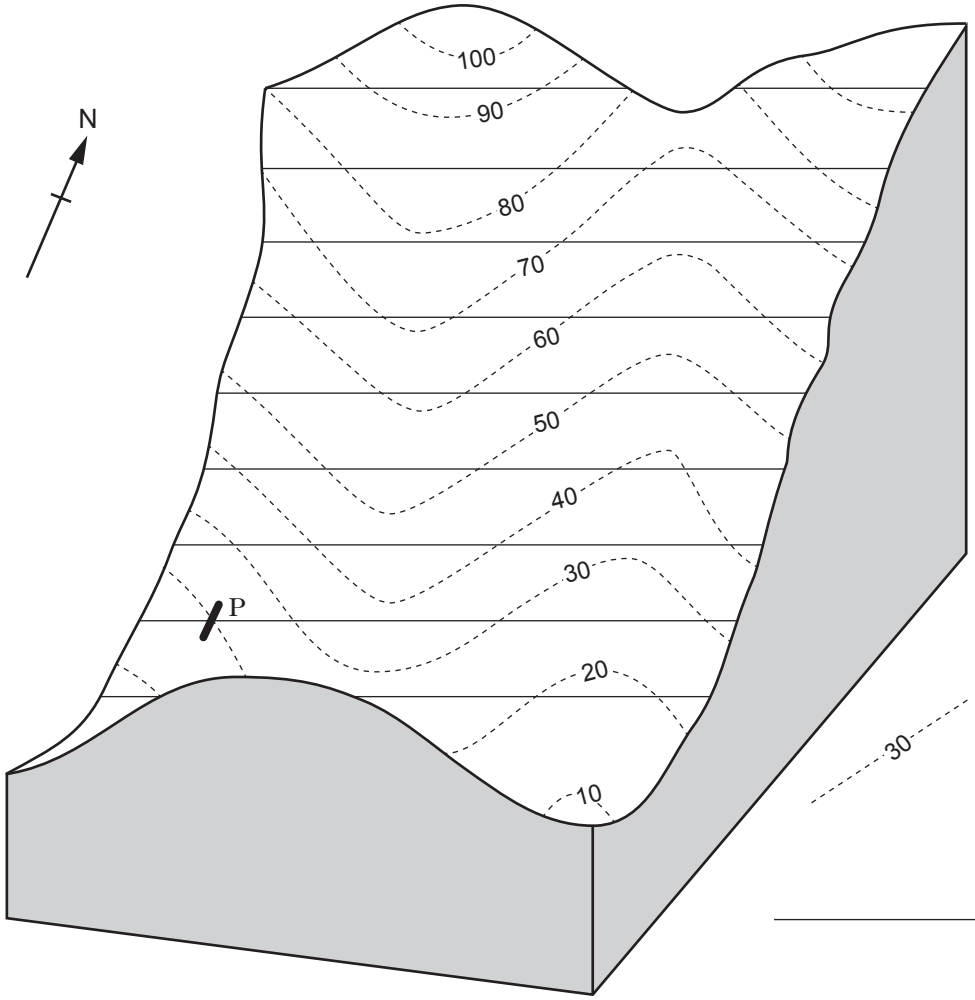
12. *Marks*



30 surface contours with height in metres

structure contours

P outcrop of coal seam

The block diagram above shows the structure contours for a coal seam that dips at a uniform angle and the surface contours for the landscape.

The coal seam outcrops at P on the diagram.

(*a*) Number the structure contours. **2**

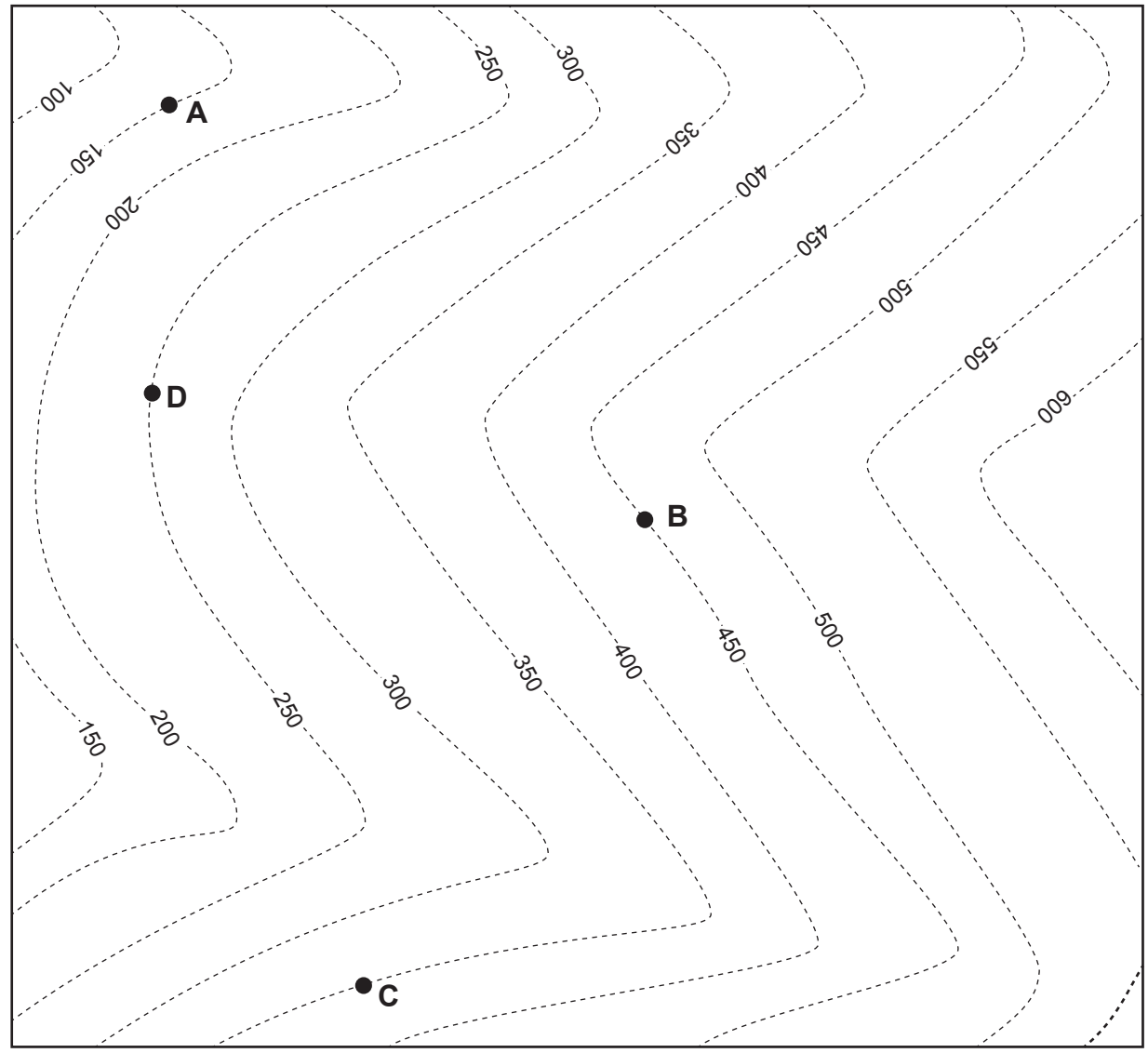
(*b*) Draw the outcrop of the coal seam. **2**

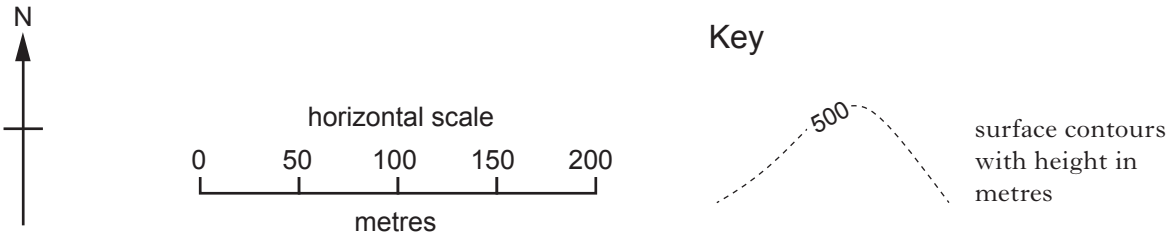
(*c*) In which direction does the coal seam dip?

..... **1**

[Turn over

13. Study the map below then answer the questions on the next page.





DO NOT WRITE IN THIS MARGIN

Marks

13. (continued)

The map on *Page twenty-four* shows a coal seam outcropping at positions A, B and C. The coal seam has a uniform dip.

(*a*) On the map, draw structure contours for the coal seam over the whole map area and number them. **2**

(*b*) Draw in the outcrop of the coal seam. **2**

(*c*) At what angle and in what direction does the coal seam dip?

Space for working

2

(*d*) At what depth would the coal seam be found in borehole D?

1

..... metres

Section C: Total (40) marks

[*END OF QUESTION PAPER*]

DO NOT WRITE IN THIS MARGIN

SPACE FOR ANSWERS OR FOR ROUGH WORK

DO NOT WRITE IN THIS MARGIN

SPACE FOR ANSWERS OR FOR ROUGH WORK

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X043/12/11

NATIONAL QUALIFICATIONS 2013

TUESDAY, 7 MAY
9.00 AM – 11.30 AM

GEOLOGY
HIGHER
Worksheet for Question 11

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

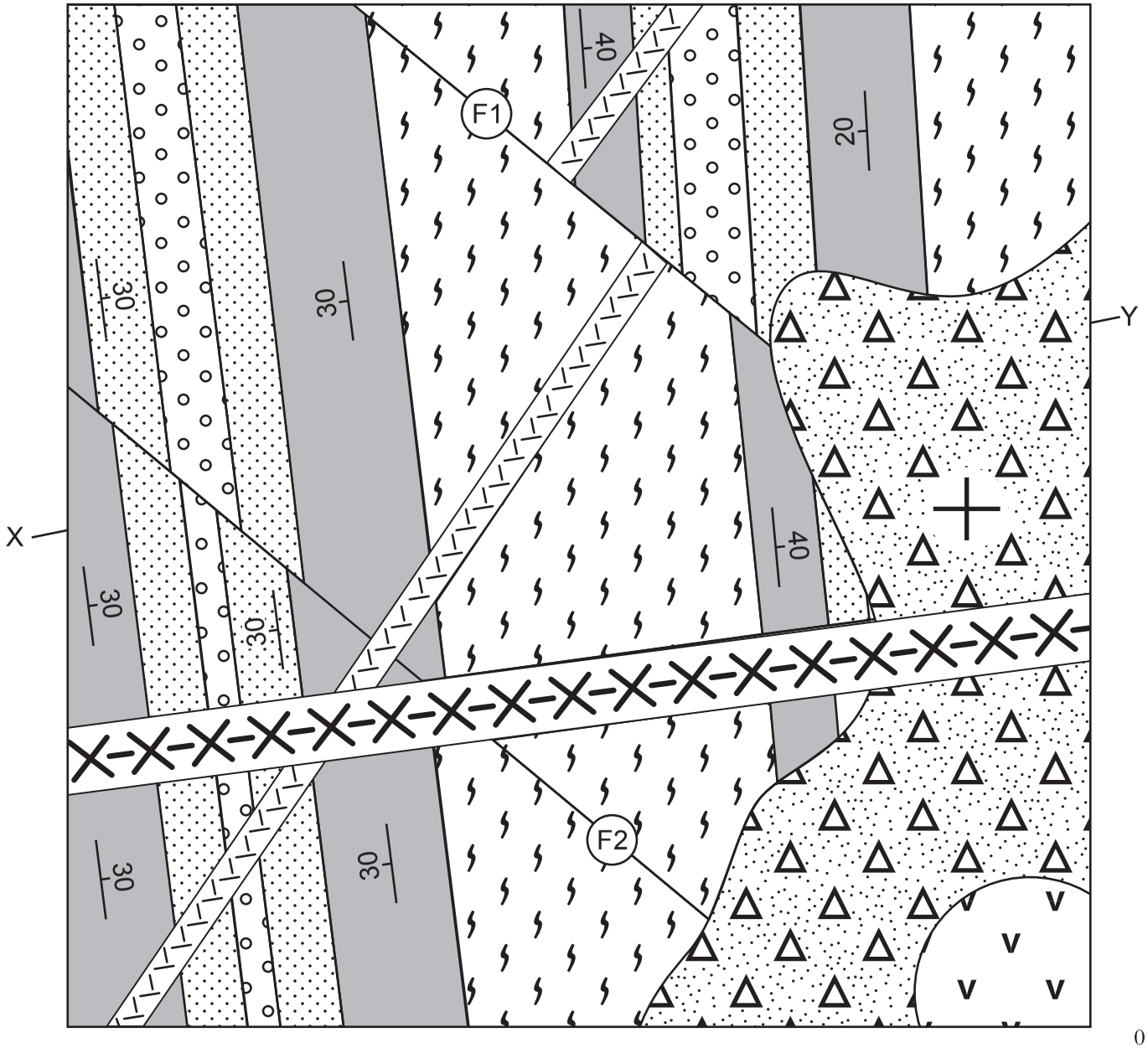
Surname

Date of birth
Day Month Year

Scottish candidate number

Number of seat

To be inserted inside the front cover of the candidate's answer book and returned with it.



Key (Rocks not in order of age)

basalt

dolerite

tuff

gneiss

shale

greywacke

volcanic vent

conglomerate

20 strike of bedding with dip in degrees

horizontal strata

F1 fault

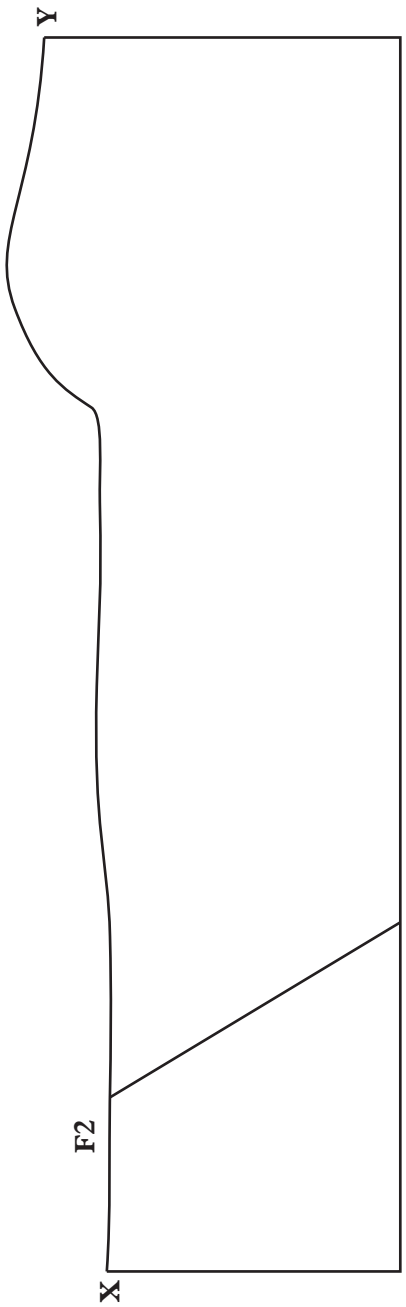
N

horizontal scale

0 50 100 150 200

metres

Figure Q11(*g*)



[*END OF WORKSHEET*]

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