Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

ADVANCED SUBSIDIARY GCE

F792

GEOLOGY

Rocks – Processes and Products

WEDNESDAY 25 MAY 2011: Morning
DURATION: 1 hour 45 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the question paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

Ruler (cm/mm)
Protractor
Electronic calculator

READ INSTRUCTIONS OVERLEAF

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INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully. Make sure you know what you have to do before starting your answer.**
- **Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.**
- **Answer ALL the questions.**

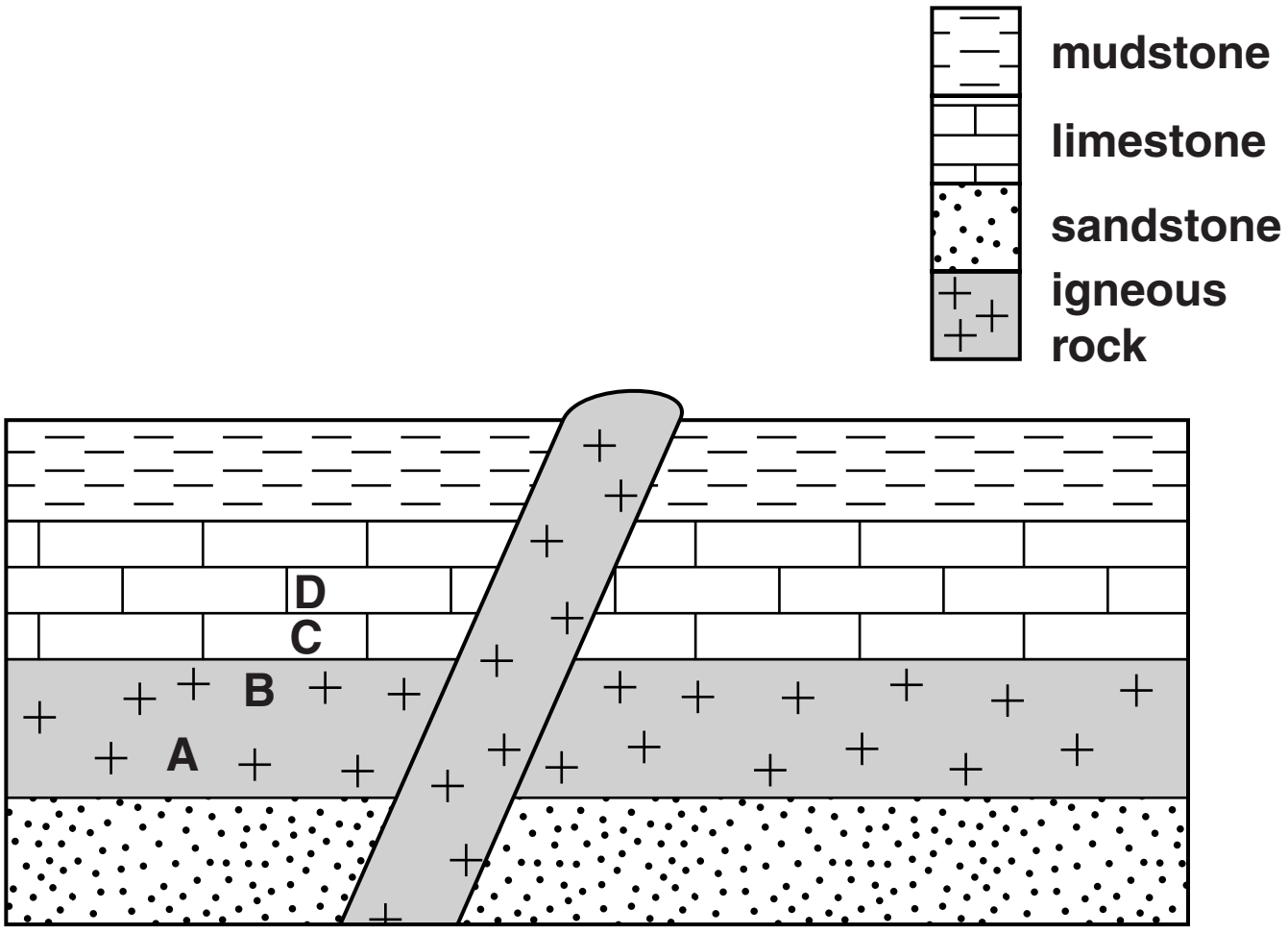
INFORMATION FOR CANDIDATES

- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **The total number of marks for this paper is 100.**
-  **Where you see this icon you will be awarded a mark for the quality of written communication in your answer.**
- **You may use an electronic calculator.**
- **You are advised to show all the steps in any calculations.**

Answer ALL the questions.

1 (a) (i) On the cross section diagram below label:

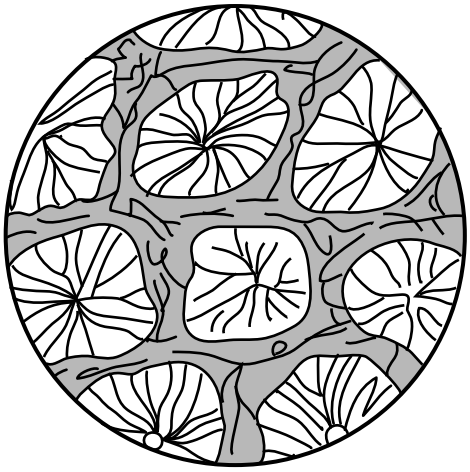
- **a dyke**
- **a sill.** **[2]**

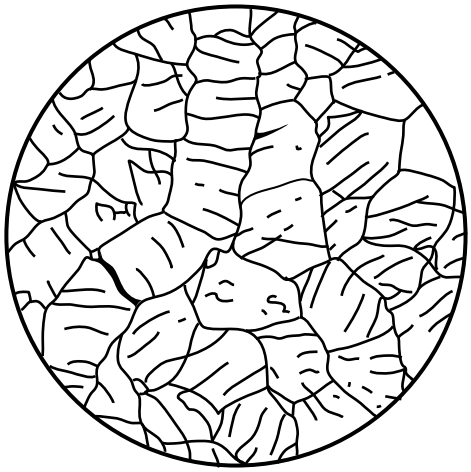


(ii) On the cross section diagram above shade and clearly label:

- **a baked margin**
- **a chilled margin.** **[2]**

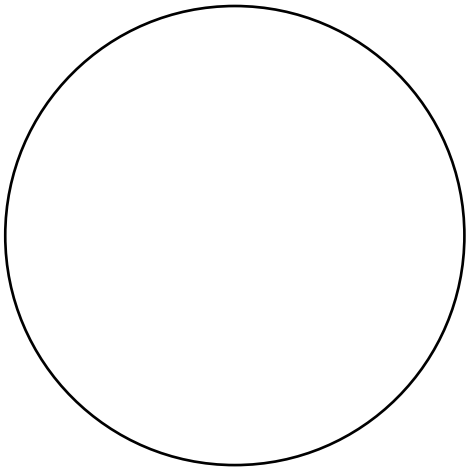
(iii) Match the rocks 1, 2, 3 and 4 shown in thin section below and on next page to the letters A, B, C and D on the cross section diagram on the previous page.

 **×10** **small crystals of feldspar and mafic minerals**	 **×1** **coral fossils and calcite cement**
rock 1	**rock 2**
_____	_____

 ×5 **crystals of calcite**	 ×1 **large crystals of feldspar and mafic minerals**
rock 3	**rock 4**
_____	_____

[3]

(b) Describe a poorly sorted sandstone with subangular grains. You may draw a diagram to help you make your description.



_____

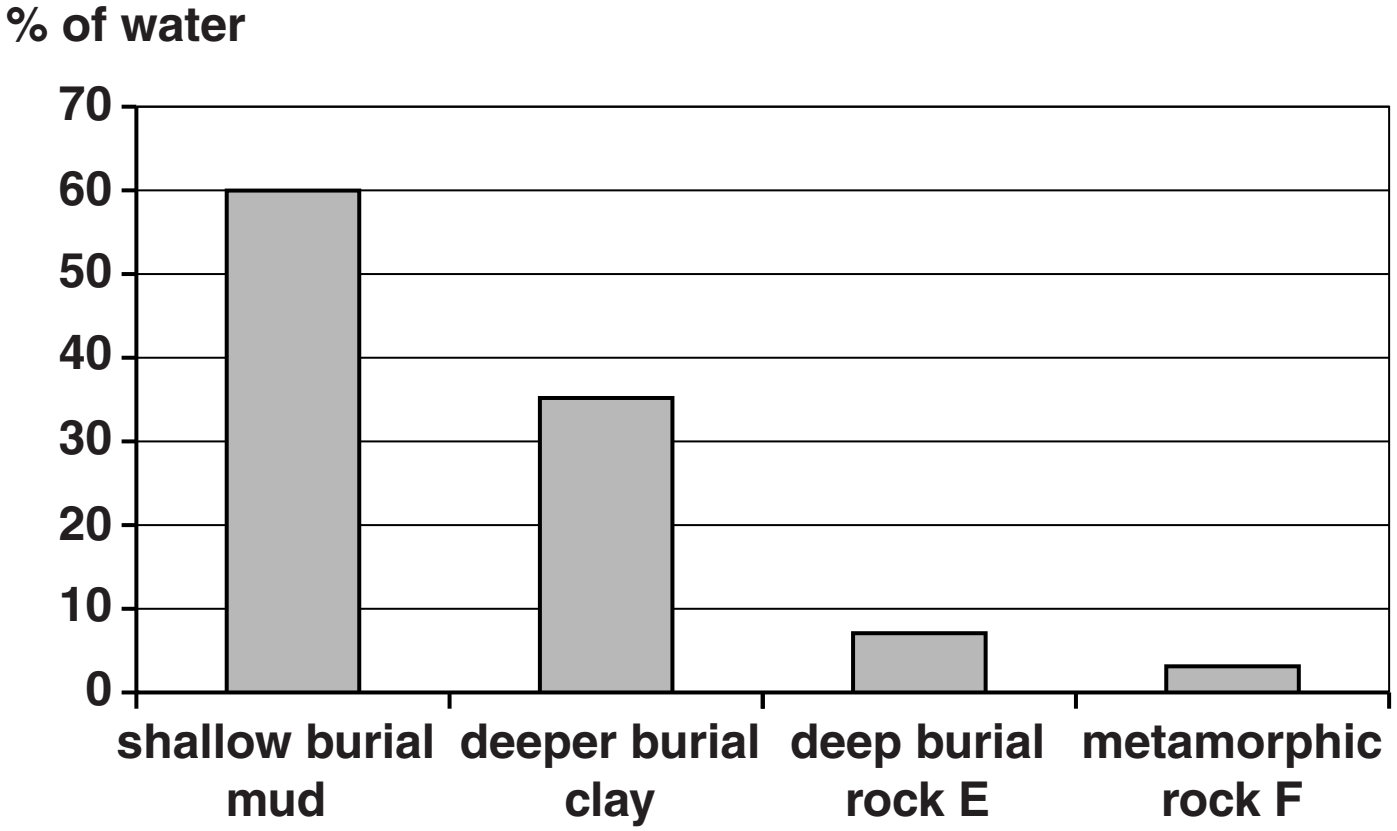
_____

_____

_____

_____ **[3]**

(c) The data below shows the effects of pressure on mud as it undergoes diagenesis and then metamorphism.



(i) Name rocks E and F.

sedimentary rock E _____

metamorphic rock F _____ **[2]**

(ii) State the reduction in water content between mud and rock E.

_____ **%** **[1]**

(iii) Describe and explain the diagenetic process that causes the reduction in water content.

_____

_____

_____

_____

_____

_____ **[2]**

(iv) State the additional factor needed for the formation of rock F.

_____ **[1]**

(d) Describe the temperature and pressure relationship between diagenesis and metamorphism.

_____

_____

_____

_____

_____

_____ **[2]**

[Total: 18]

2 Crystals which form early in the crystallisation of a mafic magma settle out under the influence of gravity (gravity settling). The table gives data on mineral density and settling velocity.

MINERAL	DENSITY (g/cm^3)	SETTLING VELOCITY (cm/hr)
augite	3.3	1.8
magnetite	4.9	6.1
olivine	3.7	2.9
plagioclase	2.7	0.3

(a) (i) Plot the data on the graph opposite. Draw a line of best fit.

(ii) Use the graph to help explain how gravity settling operates in a mafic magma.

_____

_____

_____

_____

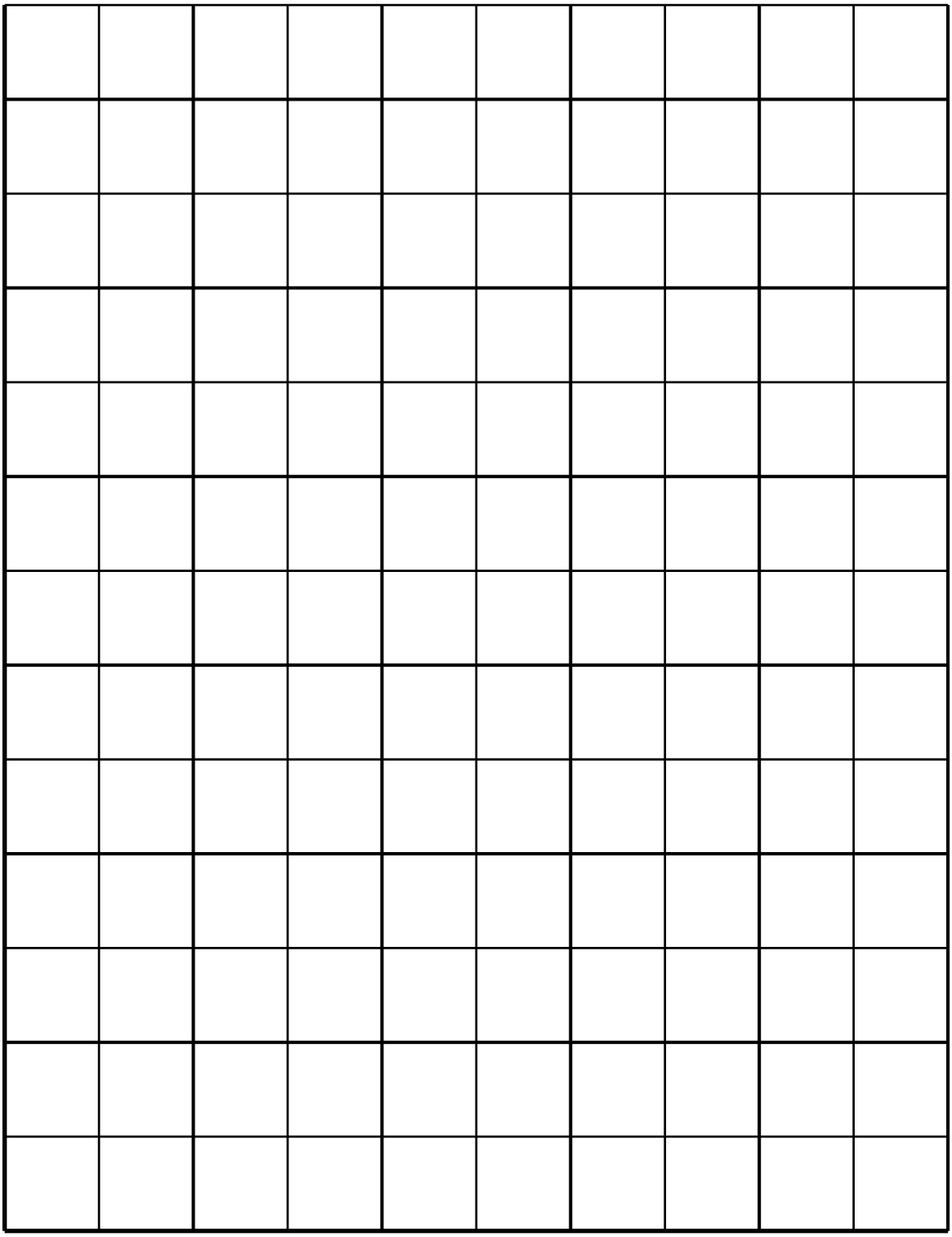
_____

_____ **[3]**

(iii) Predict the settling rate for hornblende which has a density of 3.2 g/cm^3.

_____ **cm/hr** **[1]**

settling velocity (cm / hr)



density (g/cm^3)

[3]

(b) Explain how filter pressing helps to separate minerals in a mafic magma.

_____

_____

_____

_____ **[2]**

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TURN OVER FOR QUESTION 2 (c) (i)

(c) (i) Complete the minerals of Bowen's Reaction Series on the diagram below.

[3]

(ii) Using Bowen's Reaction Series, which one of the following pairs of minerals are very UNLIKELY to be found in the same rock? Give a reason for your answer.

- **quartz and K feldspar**
- **quartz and olivine**
- **Ca plagioclase and olivine**

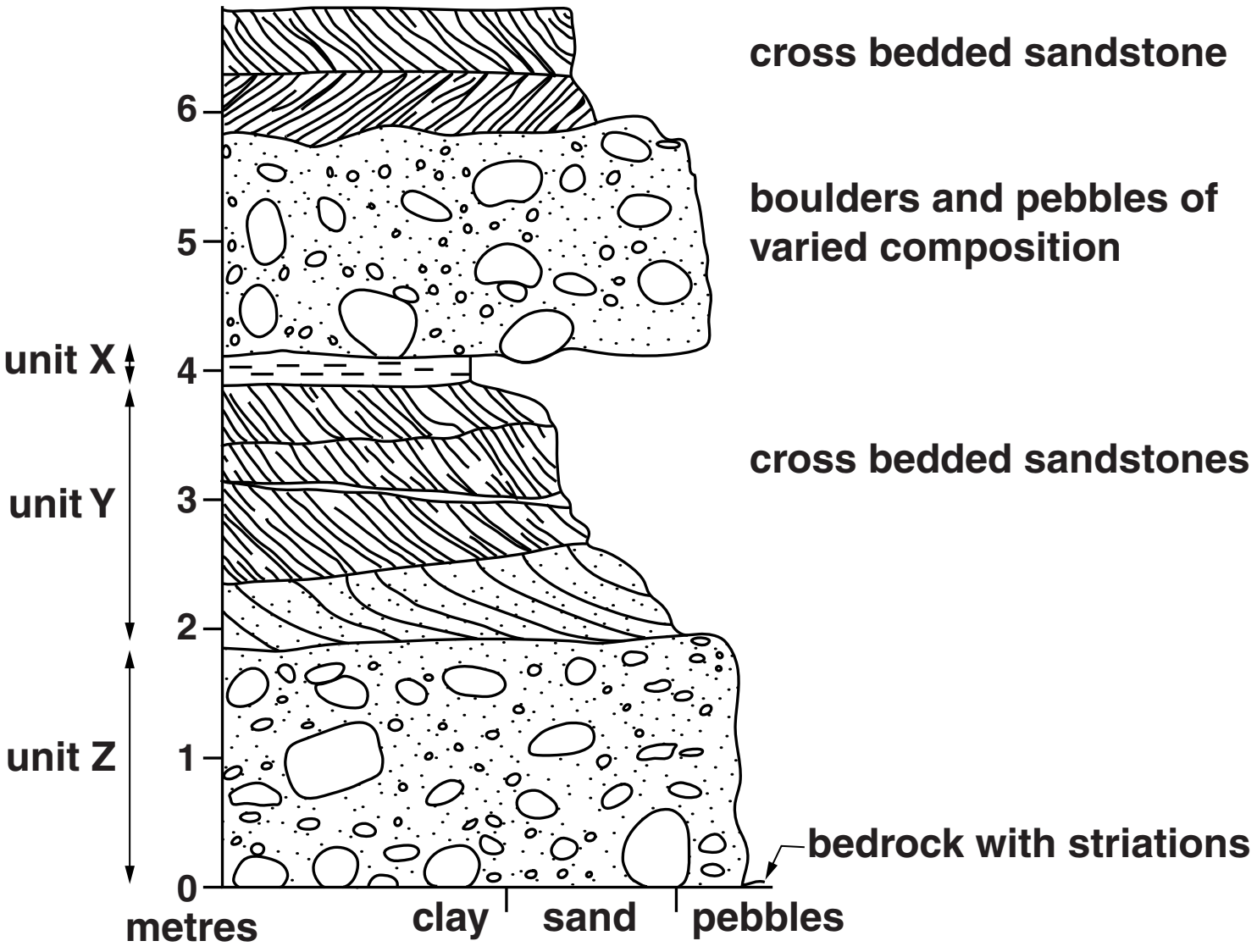
pair _____

reason _____

_____ **[2]**

[Total: 14]

3 The diagram below is a graphic log of a sequence of sedimentary rocks.



(a) Describe how the striations on the surface of the bedrock formed.

_____

_____

_____

_____ **[2]**

(b) Describe the environment of deposition for each of the three units X, Y and Z.

X _____

_____

_____

_____ **[2]**

Y _____

_____

_____

_____ **[2]**

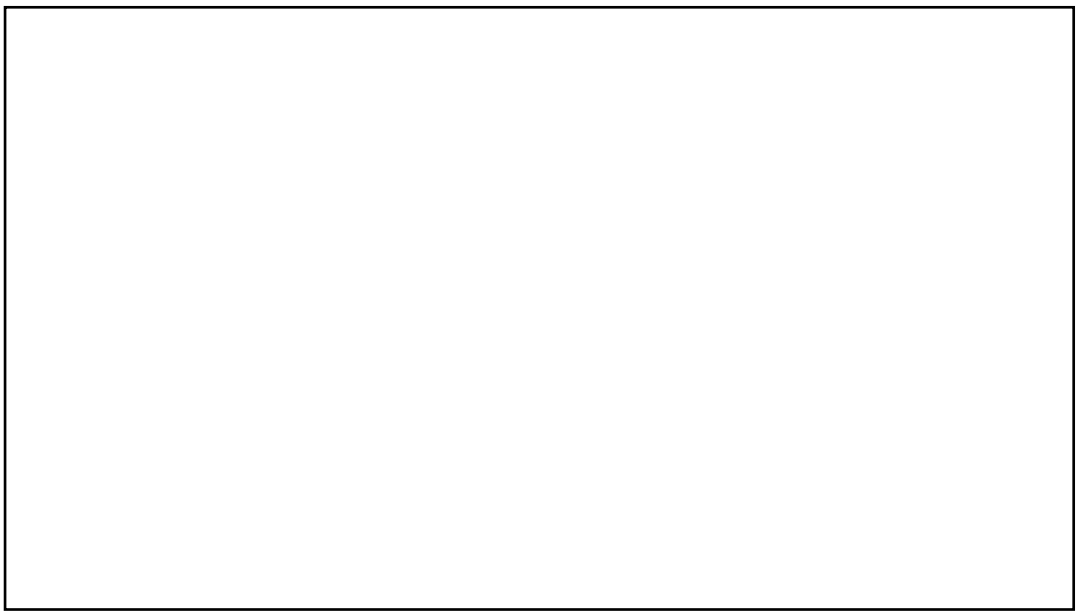
Z _____

_____

_____

_____ **[2]**

(c) Describe clearly how the cross bedding formed. You may use a diagram to help you make your description.



_____

_____

_____ **[3]**

(d) State the term used to describe the repetition of units in the graphic log.

_____ **[1]**

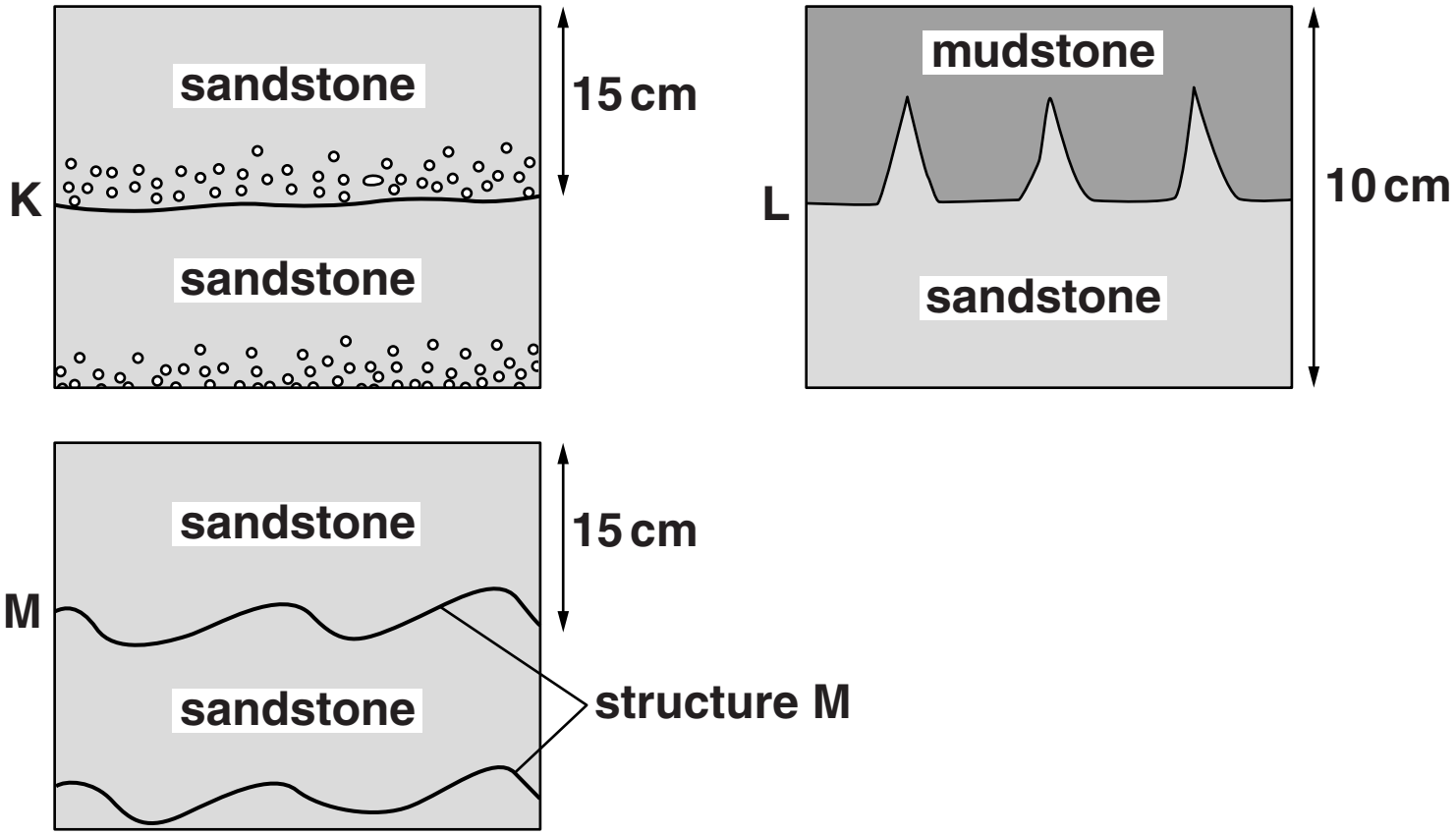
(e) The pebbles have a varied composition of igneous, sedimentary and metamorphic rocks. Identify the rocks described in the table below.

ROCK	DESCRIPTION	ROCK NAME
G	• black colour • fine grained crystalline igneous • silica content 49%	
H	• grey in colour • crystalline • composed entirely of quartz	
J	• silvery colour with black, red and white crystals • medium grained crystals • crystals aligned with muscovite mica distorted around garnet	

[3]

[Total: 15]

4 Study the diagrams below and answer the following questions.



(a) (i) Fully name the sedimentary structures in diagrams K, L and M.

K _____

L _____

M _____ **[3]**

(ii) Describe how structure K formed.

_____

_____

_____

_____ **[2]**

(iii) Sedimentary structure M can be used to determine palaeocurrent direction. Draw an ARROW on diagram M to show the direction of current flow. [1]

(b) (i) What has happened to structure L since it formed?

_____ **[1]**

(ii) Describe the environment in which structure L may have been formed.

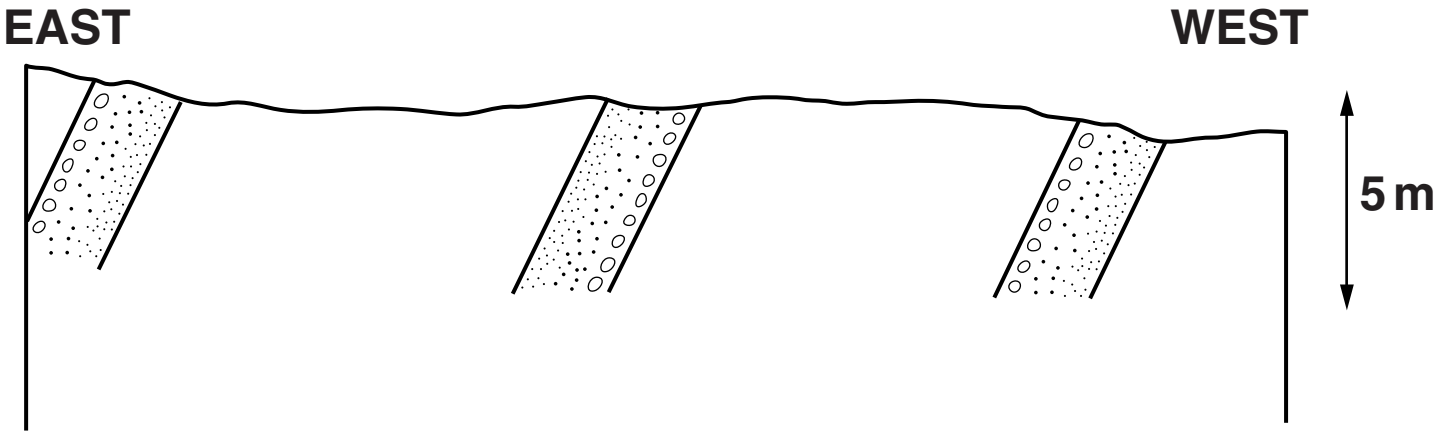
_____

_____

_____

_____ **[2]**

(c) (i) **Look at the diagram below. Describe the likely geological structures that will extend the strata above and below the land surface. Sedimentary structure K has been drawn in the bed to help. You may draw your answer on the diagram provided.**



[2]

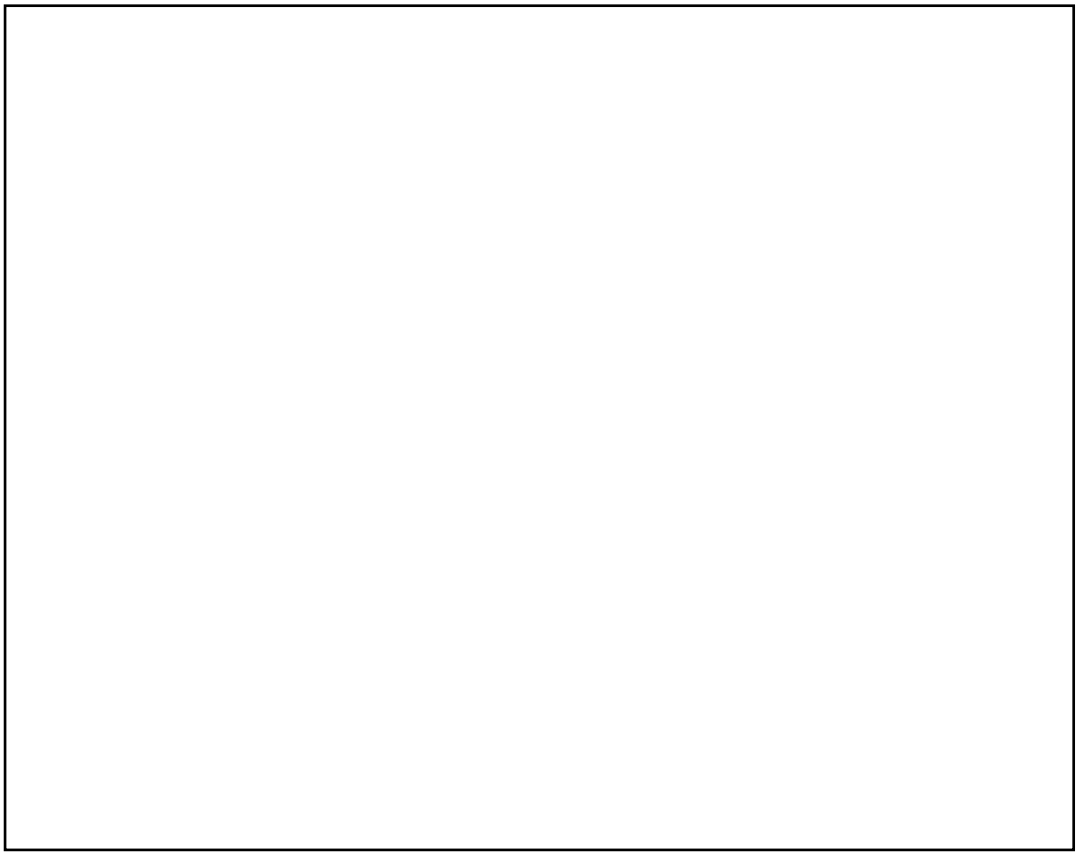
(ii) **Name and describe the position of the structures you have described in your description. Or name and label the structures if you have drawn them on a diagram.**

_____

_____

_____ **[1]**

(d) Flute casts are often found in turbidite deposits formed in deep marine basins. Describe how flute casts form. You may use a diagram to help you make your description.



_____

_____

_____

_____ **[4]**

[Total: 16]

5 (a) Sedimentary rocks can be classified into three groups.

(i) Complete the classification table below for the sedimentary rocks listed, by ticking the correct classification for each rock. Arkose has been completed for you.

	CLASTIC	NON-CLASTIC	
	mechanically formed	chemically formed	biologically formed
ARKOSE	✓		
BRECCIA			
CHALK			
COAL			
CONGLOMERATE			
EVAPORITE			
GREYWACKE			
MUDSTONE			
OOLITIC LIMESTONE			

[4]

(ii) Select the correct rock names from the table to match the rock descriptions below.

• white or light grey colour • composed of 93% calcite in the form of coccoliths • no grains seen	
• poorly sorted • coarse grained • angular clasts	
• poorly sorted • composed of 35% K feldspar, 20% rock fragments and 45% quartz • medium grain size	
• black colour • shiny layers alternating with dull layers • contains carbonaceous plant material	

[4]

(iii) State TWO ways in which the clastic sedimentary rocks are sub-divided for classification.

1 _____

2 _____ **[2]**

(b) Weathering provides most of the materials that make sedimentary rocks. Granite can be weathered by several processes.

(i) Describe how frost shattering weathers granite.

_____

_____

_____

_____ **[2]**

(ii) Describe the material produced by frost shattering of granite.

_____

_____ **[1]**

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TURN OVER FOR QUESTION 5 (b) (iii)

(iii) Granite is composed mainly of the minerals given in the table below.

NAME	CLEAVAGE	HARDNESS	COMPOSITION	
biotite mica	one perfect. Splits into thin elastic sheets	2.5	K, Mg, Fe rich aluminium silicate	$K(FeMg)_3(AlSi_3)O_{10}(OH)_2$
K feldspar	two good	6	K rich aluminium silicate	$KAlSi_2O_8$
muscovite mica	one perfect. Splits into thin elastic sheets	2.5	K rich aluminium silicate	$KAl_2(AlSi_3)O_{10}(OH)_2$
plagioclase feldspar	two perfect	6	Na rich aluminium silicate	$NaAlSi_3O_8$ to $CaAl_2Si_2O_8$
quartz	none	7	silicon dioxide	SiO_2

Describe how hydrolysis weathers granite. Use the data in the table to decide which mineral is most likely to be weathered by hydrolysis.

_____

_____

_____

_____

_____

_____ **[3]**

(iv) Describe the material produced by hydrolysis of granite.

_____

_____ **[1]**

[Total: 17]

6 Describe the grades of contact metamorphism around an intrusion and the rocks produced at each grade if the parent rock is a shale. You may use diagram(s) to illustrate your answer.

In your answer you should make clear how the rocks are linked to metamorphic grade by using the headings for low, medium and high grade metamorphism.

LOW GRADE CONTACT METAMORPHISM

MEDIUM GRADE CONTACT METAMORPHISM

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[10]**

[Total: 10]

7 Describe methods for the prediction of volcanic activity using the following headings:

- **historic patterns of activity**
- **changes in ground level**
- **changes in gases**
- **seismic activity.**

You may use diagram(s) to illustrate your answer.

In your answer you should link the method to how it is used for prediction.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ **[10]**

[Total: 10]

END OF QUESTION PAPER

ADDITIONAL PAGE

IF ADDITIONAL SPACE IS REQUIRED, YOU SHOULD USE THE LINED PAGE BELOW. THE QUESTION NUMBER(S) MUST BE CLEARLY SHOWN.

ADDITIONAL PAGE

ADDITIONAL PAGE

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