OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

GEOLOGY 2835

Petrology

Monday **12 JUNE 2006** Morning 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Ruler (cm/mm)

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers in the spaces on the question paper.
- Read each question carefully and make sure you know what you have to do before starting your answer.

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 90.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- Some questions in this paper are synoptic in nature. In your answer to these questions you are encouraged to show your knowledge and understanding of different areas of Geology and apply these and the geological skills you have learned, to the situations in the questions.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	18	
2	17	
3	17	
4	13	
5	25	
TOTAL	90	

This question paper consists of 14 printed pages and 2 blank pages.

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Answer **all** the questions.

1 The table below shows the chemical composition by percentage of oxides of four igneous rocks **A**, **B**, **C** and **D**.

oxide %	**A**	**B**	**C**	**D**
SiO_2	46.0	73.0	60.0	43.5
Al_2O_3	15.0	13.0	17.0	4.0
Fe oxides	12.0	2.0	6.0	12.5
MgO	9.0	0.5	3.5	34.0
CaO	9.0	1.5	7.0	3.5
Na_2O	3.5	4.0	3.5	0.5
K_2O	1.5	4.0	1.5	0.3
others	4.0	2.0	1.5	1.7

(a) (i) To which igneous rock groups do **A**, **B**, **C** and **D** belong?

A.....

B.....

C.....

D..... [4]

(ii) Describe the changes in the % of oxides of silicon and sodium compared to iron and magnesium across the four rock groups.

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.....[2]

(iii) How is it possible for rock **D** to contain 43.5% SiO_2 but no quartz?

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(b) The photomicrographs below are of the four rocks A, B, C and D.

A diagram has been removed due to third party copyright restrictions

Details:

A diagram showing photomicrographs of four different rocks

(i) Describe with reference to the photomicrograph of rock C what is meant by the term average crystal grain size .

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.....[1]

(ii) Estimate the average crystal grain size of photomicrograph D.

.....mm [1]

(iii) Name the texture found in photomicrograph C and explain how it formed.

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.....[2]

(iv) Name the different texture found in photomicrograph A and explain how it formed.

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(c) Igneous rocks are also classified by their mineral content.

(i) Define the term *mafic mineral*.

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.....[1]

(ii) Name **two** mafic minerals that may occur in rock **D**.

.....[1]

(iii) Rocks **A**, **B** and **C** all contain plagioclase feldspar. Explain how the composition of the plagioclase varies between these three rocks.

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.....[2]

[Total: 18]

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Turn to page 6 for Question 2.

2 The diagram below shows the geography of an area that has a hot, dry climate. Heavy rain sometimes falls in the mountains but no rivers reach the sea.

A diagram has been removed due to third party copyright restrictions

Details:

A diagram of showing a geographical area that has a hot, dry climate with heavy rain falling in the mountains

(a) (i) What type of clastic sediment would probably be deposited at points E and G?

E .....

G .....[2]

(ii) Explain why there is a variation in the type of sediment deposited.

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.....[1]

(b) (i) Describe the characteristics of sediment E in terms of both textural and compositional maturity.

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.....[2]

(ii) Name a possible rock type that may form from sediment E.

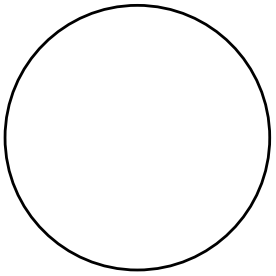
.....[1]

(iii) What name is given to the environment of deposition of sediment E?

.....[1]

(c) Location **F** consists primarily of sands.

With the aid of a fully labelled thin section diagram, fully describe a sandstone that would be deposited in this environment. Include an appropriate scale.



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(d) The lake found in the lowland area is temporary.

(i) What name is given to this temporary lake?

.....[1]

(ii) Explain the origin of the evaporite minerals that may be found within the sediments in the temporary lake.

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(iii) The sedimentary rocks formed in location **G** often contain salt pseudomorphs. Explain how these form.

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.....[2]

(e) The clastic sediments found in locations **E** and **F** contain minerals **H**, **I** and **J**. Identify the three minerals. Write your answers in the spaces in the table.

mineral	**H**	**I**	**J**
hardness	6.0	7.0	2.5–3.0
density g / cm^3	5.0	2.7	2.7–3.3
colour	red-brown	colourless to white	black or dark brown
lustre	metallic or dull	vitreous	vitreous to pearly
other features	red-brown streak	conchoidal fracture	1 perfect cleavage
mineral name			

[3]

[Total: 17]

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Turn to page 10 for Question 3.

3 **(a)** Describe how the following factors control metamorphism.

temperature .....

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.....[2]

pressure .....

.....

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.....[2]

(b) Regional metamorphic rocks form as a result of changes in both temperature and pressure.

(i) Name the rock type that is formed as a result of the regional metamorphism of

pure limestone .....[1]

pure sandstone .....[1]

(ii) Explain why shales give rise to a wide variety of new metamorphic minerals when regionally metamorphosed.

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.....[2]

(iii) Define the following terms:

metamorphic zone .....

.....[1]

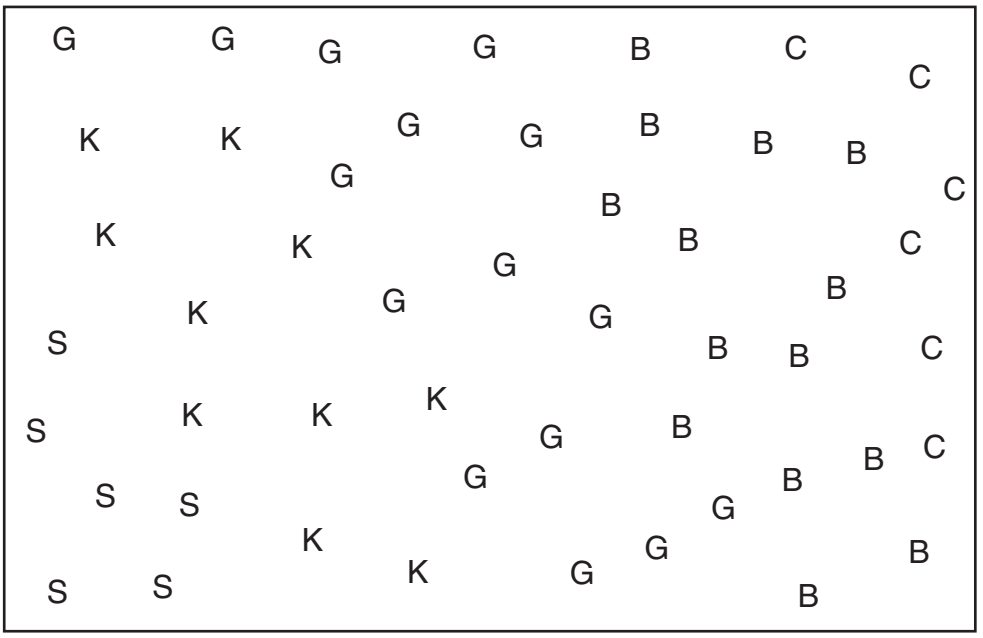
index mineral .....

.....[1]

isograd .....

.....[1]

(iv) Complete the map below by drawing isograds to show the index mineral zones.



N

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KEY

C	chlorite
B	biotite
G	garnet
K	kyanite
S	sillimanite

[2]

(c) Clay minerals when metamorphosed often react to form Al_2SiO_5 polymorphs. Explain the relationship between the Al_2SiO_5 polymorphs and temperature and pressure during metamorphism.

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.....[2]

(d) Chemical reactions take place during metamorphism.

(i) Complete the following metamorphic reaction.

calcite + silica → ..... + carbon dioxide [1]

(ii) Explain why this reaction is unlikely to be reversible.

.....

.....[1]

[Total: 17]

4 The map below shows the zoning of ore minerals around a granite intrusion in Cornwall.

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Details:

A map showing the zoning of ore materials around a granite intrusion in cornwall

(a) (i) Name the main ore minerals of:

tin .....

copper .....

lead .....

zinc .....[4]

(ii) Explain the processes responsible for the mineral zoning.

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.....[2]

(b) The minerals often occur in veins.

(i) These veins often contain ore minerals and gangue minerals. Explain what is meant by a gangue mineral and give an example.

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example .....[2]

(ii) Draw a labelled cross section through such a mineral vein.

[2]

(c) Pegmatites are often formed as a result of late-stage igneous processes. Explain how pegmatites form.

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.....[3]

[Total: 13]

5 In this question, two marks are available for the quality of written communication. You may use diagrams to illustrate your answer.

Answer **both** parts of this question

(a) Describe the processes of differentiation by which a variety of rock types can be produced from a single parent magma.

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(b) Describe the characteristic products of limestone sedimentation in clear, non-clastic shallow marine environments. Explain the processes which formed these limestones.

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For Examiner's Use

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Quality of Written Communication [2]

END OF QUESTION PAPER

[Total: 25]

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