Candidate Forename | Candidate Surname

Centre Number | Candidate Number

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
ADVANCED SUBSIDIARY GCE

F792
GEOLOGY
Rocks – Processes and Products

WEDNESDAY 20 MAY 2009: Afternoon
DURATION: 1 hour 45 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

Candidates answer on the question paper

OCR SUPPLIED MATERIALS:
None

OTHER MATERIALS REQUIRED:
Electronic Calculator
Ruler (cm/mm)

READ INSTRUCTIONS OVERLEAF
INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer ALL the questions.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

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 marks 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.
1  (a) Complete the flow diagram below by entering the names of the correct broad rock groups in boxes A, B, C and D.

Answer **ALL** the questions.

- **A**: crystalline
- **B**: clastic
- **C**: composed mainly of calcite or quartz
- **D**: alignment of minerals

- Texture: crystalline → yes → B
- Texture: clastic → no → A
- Alignment of minerals: yes → B
- Alignment of minerals: no → D
- Composed mainly of calcite or quartz: yes → C
- Composed mainly of calcite or quartz: no → D
(b) (i) Define the terms

*clastic* _________________________________

_______________________________________

*crystalline* ________________________________

_______________________________________ [2]

(ii) Define the term *rock*.

_______________________________________ [1]

(iii) Explain the processes that cause minerals to be aligned in metamorphic rocks.

_______________________________________

_______________________________________

_______________________________________

_______________________________________ [2]
(c) Below are thin section diagrams of two rocks.

E  
groundmass of mafic minerals and plagioclase feldspar

plagioclase feldspar

10mm

F  
fine grained calcite cement

1mm

(i) Circle the broad rock group to which each rock belongs.

E  igneous  metamorphic  sedimentary

F  igneous  metamorphic  sedimentary  [2]

(ii) Give TWO reasons for your choice for E.

1  ______________________________________

_____________________________________

2  ______________________________________

_____________________________________

[2]
(iii) Give **TWO** reasons for your choice for F.

1. ______________________________________
   ______________________________________

2. ______________________________________
   ______________________________________ [2]

[Total: 14]
(a) The diagram below shows different types of sediment transport.

(i) Define the term **suspension**.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________ [2]
(ii) Explain why the same grain can be transported by suspension and by saltation at different times.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________ [2]

(iii) Describe and explain ONE difference between grains transported by ice and by wind.

difference ______________________________________________________________

__________________________________________________________________________

reason ________________________________________________________________

__________________________________________________________________________ [2]
(b) The diagram below shows sediments deposited by a meandering river.

(i) Label on the diagram where sediment is being eroded. [1]

(ii) List TWO sedimentary structures that will be found in the meandering river deposits shown.

_______________________________________

_______________________________________ [2]

(iii) Explain why the sediment at 1 is older than the sediment at 2.

_______________________________________

_______________________________________

_______________________________________

_______________________________________ [2]
(c) The sequence of sediments shown on the diagram is a fining up sequence. Explain how it formed.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

[Total: 14]
3 The graph below shows the cumulative frequency curve for sediment G. The table shows the grain size distribution for sediment H.
<table>
<thead>
<tr>
<th>grain size (phi $\phi$)</th>
<th>mass (%)</th>
<th>cumulative mass (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

sediment H

(a) (i) Using the data
- complete the table to show the cumulative mass % for sediment H.
- plot the data on the graph
- draw the cumulative frequency curve.  [3]

(ii) Define the term sorting.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________  [2]
(iii) Using the cumulative frequency curves and the information below, calculate the coefficient of sorting for sediments G and H. Show your working.

\[
\text{coefficient of sorting} = \frac{\phi_{84} - \phi_{16}}{2}
\]

(Where \(\phi_{84}\) is the grain size of the cumulative mass of 84% of the sample and \(\phi_{16}\) is the grain size of the cumulative mass of 16% of the sample.)

\[
\text{coefficient of sorting } G = \_______________
\]

\[
\text{coefficient of sorting } H = \_______________ [3]
\]
<table>
<thead>
<tr>
<th>coefficient of sorting</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;0.50</td>
<td>well sorted</td>
</tr>
<tr>
<td>0.50 – 1.00</td>
<td>moderately sorted</td>
</tr>
<tr>
<td>&gt;1.00</td>
<td>poorly sorted</td>
</tr>
</tbody>
</table>

(iv) Describe the difference in sorting between sediment G and sediment H.

________________________________________________________________________
________________________________________________________________________ [1]

(v) Identify possible environments in which sediments G and H were formed.

G ______________________________________

H ______________________________________ [2]
(b) Sandstones can be classified using composition and grain shape. The thin section diagrams below show three different sandstones.

sandstone J

sandstone K

sandstone L

(i) Identify sandstone J. Use the characteristics shown in the diagram to explain the environment in which J was deposited.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
[2]
(ii) Use the characteristics shown in the diagram to explain why sandstone $K$ was deposited in the sea.

________________________________________________________________________
________________________________________________________________________ [1]

(iii) Compare the grain shape of sandstones $K$ and $L$ and explain how this is used to determine the degree of transport.

________________________________________________________________________
________________________________________________________________________ [1]

(iv) Analyse the characteristics shown in the diagram to determine the environment of deposition of sandstone $L$.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________ [2]

[Total: 17]
The diagram below shows a sequence of processes that operate in the rock cycle.

(a) (i) Complete the sequence by entering the name of the correct process in each box above. Choose from the list below.

CRYSTALLISATION
MAGMA ACCUMULATION
METAMORPHISM
RECRYSTALLISATION
TRANSPORT

(ii) Describe the process of compaction.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________ [2]
(iii) Describe the process of cementation.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________ [2]
(b) The diagram below shows zones of metamorphic rocks around a granite intruded into shales.

(i) Name and describe the characteristic rocks and index minerals found in each of the three zones.

1  ______________________________________
   ______________________________________
   ______________________________________

2  ______________________________________
   ______________________________________
   ______________________________________

3  ______________________________________
   ______________________________________
   ______________________________________
(ii) Draw a labelled diagram and describe the metamorphic rock produced if the parent rock was sandstone.

If you cannot draw the diagram you may provide a clear description.
(iii) Explain the difference between a metamorphic aureole and a baked margin.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________ [2]

[Total: 19]
The diagram opposite shows part of Bowen’s Reaction Series. The table shows some of the characteristic properties of the rock forming minerals.

<table>
<thead>
<tr>
<th>NAME</th>
<th>SPECIFIC GRAVITY</th>
<th>HARDNESS</th>
<th>CLEAVAGE</th>
<th>COMPOSITION</th>
<th>COLOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>quartz</td>
<td>2.7</td>
<td>7</td>
<td>none</td>
<td>glassy grey or white</td>
<td>silicic dioxide</td>
</tr>
<tr>
<td>K feldspar</td>
<td>2.6</td>
<td>6</td>
<td>two good</td>
<td>pink or white</td>
<td>K rich aluminium silicate</td>
</tr>
<tr>
<td>plagioclase feldspar</td>
<td>2.7</td>
<td>6</td>
<td>two good</td>
<td>white or grey</td>
<td>Na or Ca rich aluminium silicate</td>
</tr>
<tr>
<td>biotite mica</td>
<td>3</td>
<td></td>
<td>one perfect</td>
<td>deep brown to black</td>
<td>K, Mg, Fe rich aluminium silicate</td>
</tr>
<tr>
<td>muscovite mica</td>
<td>2.8</td>
<td></td>
<td>one perfect</td>
<td>pale silvery</td>
<td>K rich aluminium silicate</td>
</tr>
<tr>
<td>hornblende (amphibole)</td>
<td>3.2</td>
<td></td>
<td>two good</td>
<td>black or greenish black</td>
<td>Na or Ca rich aluminium silicate</td>
</tr>
<tr>
<td>augite (pyroxene)</td>
<td>3.4</td>
<td></td>
<td>two good</td>
<td>black or greenish black</td>
<td>Ca, Mg, Fe rich aluminium silicate</td>
</tr>
<tr>
<td>olivine</td>
<td>3.4</td>
<td></td>
<td>none</td>
<td>Mg, Al silicate</td>
<td></td>
</tr>
</tbody>
</table>

- **SPECIFIC GRAVITY**: The density of the mineral.
- **HARDNESS**: A measure of a mineral's resistance to scratching.
- **CLEAVAGE**: The ability of a mineral to split into thin sheets.
- **COMPOSITION**: The chemical composition of the mineral.
- **COLOUR**: The color of the mineral.
(a) (i) Draw a labelled arrow on the diagram of Bowen’s Reaction Series to show increasing temperature. [1]

(ii) Identify the minerals 1 – 4 on Bowen’s Reaction Series. Write your answers in the boxes above. [3]

(iii) Explain how plagioclase feldspar forms a continuous reaction series.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________ [2]
(b) (i) Name **TWO** of the minerals likely to be found in mafic igneous rocks. Give a reason for each of your answers.

1. ______________________________________
   ______________________________________

2. ______________________________________
   ______________________________________ [2]

(ii) Using the data provided explain how you would distinguish between the white minerals quartz and plagioclase feldspar.

   ______________________________________
   ______________________________________
   ______________________________________
   ______________________________________ [2]
(c) (i) The photograph below is of a granite (a drawing of the photograph is also supplied). Identify from the photograph the correct minerals from the descriptions below. Put the correct letter in each box.

- black, with perfect cleavage that forms flakes

- pink phenocrysts of hardness 6

[2]
(ii) State **TWO** other minerals that are present in the granite.

1  ______________________________________

2  ____________________________________

[1]
(d) Describe how fractional crystallisation and gravity settling allow an intermediate rock to be formed from a mafic magma.

____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________ [3]

[Total: 16]
Describe the grades of regional metamorphism and the rocks produced at each grade. You may use diagrams to illustrate your answer.

In your answer you should make clear how the rocks are linked to metamorphic grade.
7 Describe and explain the essential features of strato-volcanoes and shield volcanoes. You should use diagrams to illustrate your answer.

In your answer you should refer to:
- magma viscosity
- lava type
- gas content
- shape and structure of the volcanoes in your answer.
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