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OXFORD CAMBRIDGE AND RSA EXAMINATIONS
A2 GCE
F794
GEOLOGY
Environmental Geology

MONDAY 23 JANUARY 2012: Afternoon
DURATION: 1 hour

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, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer ALL the questions.
- 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 page at the end of this booklet. The question number(s) must be clearly shown.

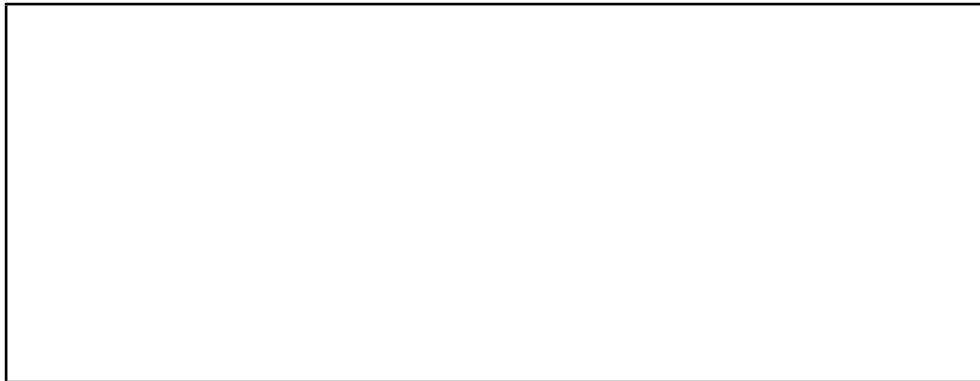
INFORMATION FOR CANDIDATES

- 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 60.
-  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.

Answer ALL the questions.

1 Slope stability is a major concern for engineering geologists during road construction.

(a) (i) Describe and explain the type of failure that will affect slopes made of clay. You may use diagrams to help you write your answer.



[2]

(ii) Evaluate TWO geological factors influencing slope stability in a well-bedded sandstone.

[2]

(b) (i) Explain why heavy rain decreases rock slope stability.

[2]

(ii) Suggest ONE human activity that can increase the likelihood of slope failure.

[1]

(c) Ground improvement strategies are used to stabilise rock slopes. Using the list below, complete the table by inserting the MOST suitable ground improvement method for each purpose.

RETAINING WALL

ROCK BOLTS

SHOTCRETE

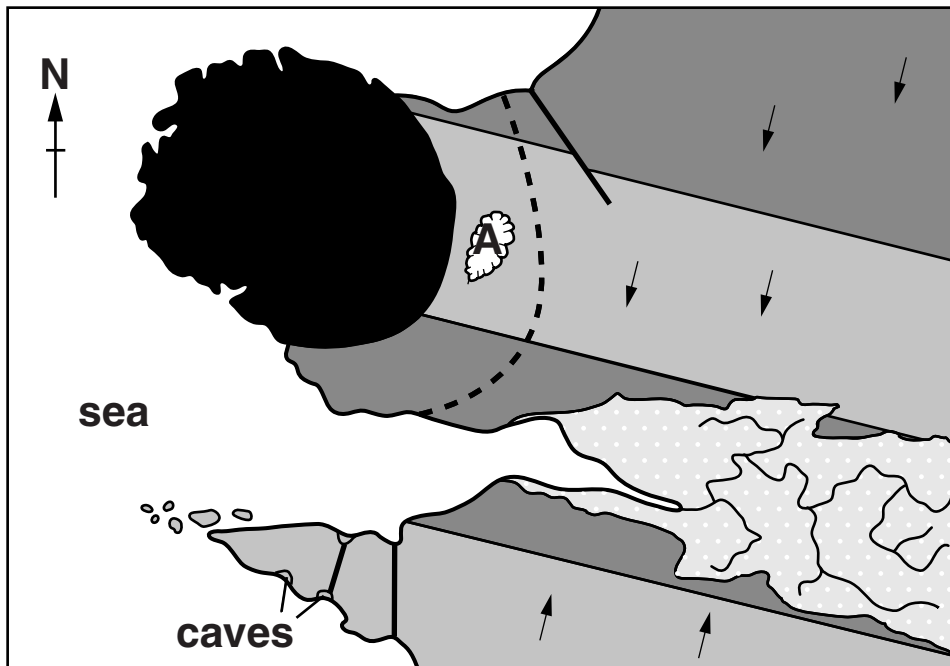
WIRE NETTING

GROUND IMPROVEMENT METHOD	PURPOSE
	to fix surfaces in place and catch small rock falls
	to protect the sides of a road cutting from weathering
	to support the sides of a road cutting

[3]

[Total: 10]

2 The map below shows the geology of an area of coastline.



Key:

- | | | | | | | | |
|--|--------------------------|---|----------------------|--|--------|---------|--|
|  | recent sands and gravels |  | well jointed granite |  | fault | 0 500 m | |
|  | limestone |  | mudstone |  | quarry | | |
|  | | | |  | river | | |
| --- | edge of altered rock | | | | | | |

(a) (i) What name is given to the area of altered rock around the igneous intrusion?



In your answer, you should use the appropriate technical term, spelled correctly.

_____ [1]

(ii) What rock type will be quarried at A?

_____ [1]

(iii) Suggest an economic use for this rock type and describe the properties of the rock that make it suitable for this use.

use _____

properties _____

_____ **[3]**

(b) Recent unconsolidated sands and gravels are being extracted from the river valley shown on the map.

(i) Name and describe a method that could be used to extract the sand and gravel.

_____ **[2]**

(ii) Describe ONE environmental consequence of this method of extraction.

[1]

(iii) Describe the properties the following construction materials need for the stated uses:

sand and gravel for concrete _____

aggregate for roadstone _____

[2]

(c) Assess and explain how the rock types and geological structure control the shape of the coastline shown on the map.

[4]

[Total: 14]

3 The cross section diagram on the loose sheet shows the subsurface geology of an area where a seismic survey is being carried out to explore for offshore oil and gas deposits.

(a) (i) The first stage of the survey involves data acquisition. Draw on the cross section on the loose sheet in the same way as that drawn for hydrophone H1, the paths of the seismic waves from the source that will arrive at hydrophones H2 and H5 from the same reflective layer. [2]

(ii) The second stage of the survey involves converting the data into a seismic profile shown in two way time (TWT). The two way time is the time taken for a surface generated seismic wave to reach a reflective layer and return to the surface.

Measure the vertical two way times (TWT) in milliseconds through the water and through the rock to the REFLECTIVE LAYER shown on the cross section on the loose sheet. Write your answers in the spaces in the table.

MATERIAL	TYPICAL SEISMIC VELOCITY (METRES/SECOND)	TWT THROUGH WATER AND THROUGH ROCK TO THE REFLECTIVE LAYER (MILLISECONDS)
water	1500	
rock	5000	

[1]

- (iii) Calculate the total depth to the REFLECTIVE LAYER in metres. Use the typical seismic velocities through water and rock shown in the table and the two way times you have measured. Show your working.

total depth _____ m [2]

- (b) (i) Describe how exploration drilling for oil and gas is carried out.

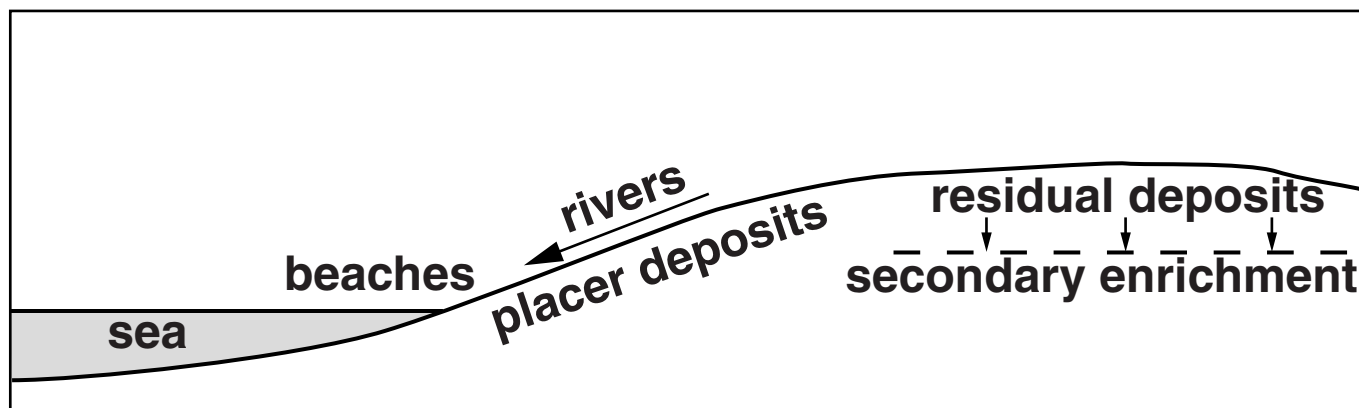
- (ii) Draw a vertical borehole on the cross section diagram on the loose sheet to show the MOST suitable position to drill a production well into an oil and gas trap. [1]

(iii) Analyse the subsurface geology to explain your choice of site.

[3]

[Total: 12]

- 4 The cross section diagram below shows three different types of ore deposits where metallic minerals have been concentrated.



not to scale

- (a) (i) Define the term **CONCENTRATION FACTOR**.

_____ [1]

- (ii) What term is used to describe the minimum amount of metal that is economic to mine?



In your answer, you should use the appropriate technical term, spelled correctly.

_____ [1]

- (iii) Name an ore mineral likely to be concentrated in each of the deposits shown on the diagram.

placer deposits _____

residual deposits _____

secondary enrichment _____ [3]

(b) Explain how placer deposits can form at a plunge pool in a river. You may draw diagrams to help explain your answer.



[3]

(c) Describe the similarities and differences in the processes that form residual and secondary enrichment deposits.

[3]

(d) (i) Explain why heavy metal contamination of soils is a threat to human health.

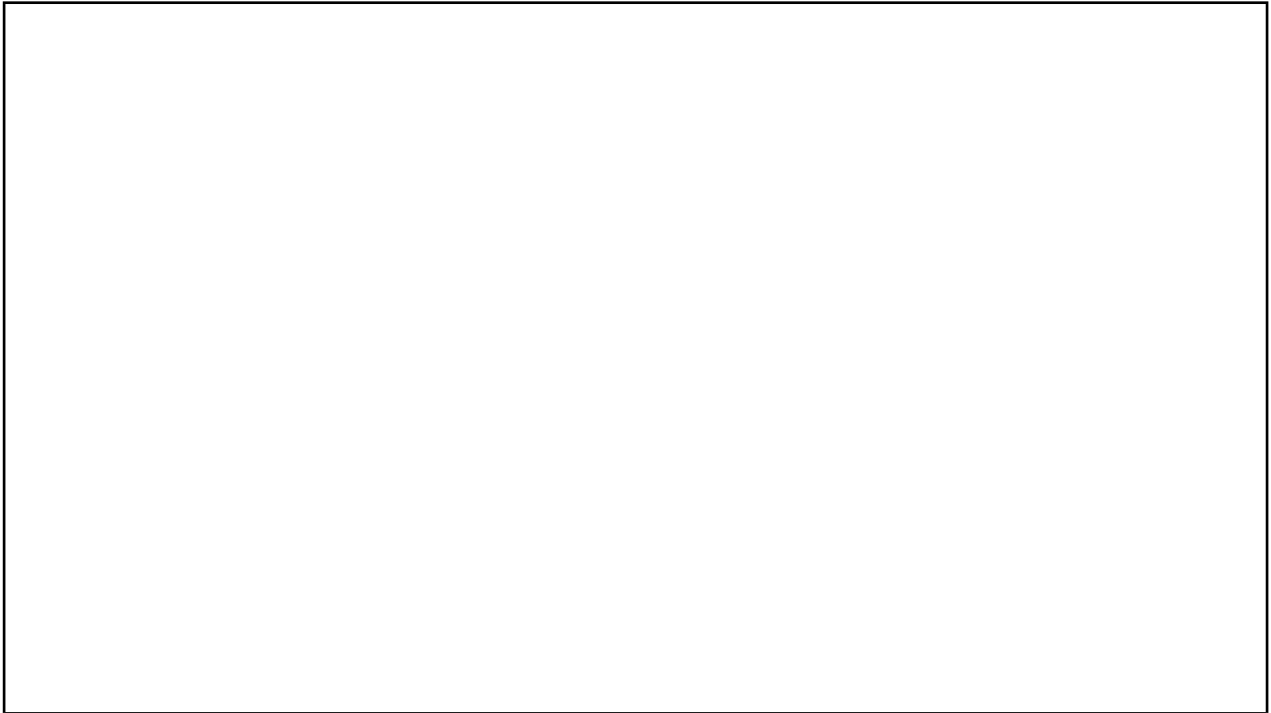
[2]

(ii) Describe how geochemical survey methods could be used to recognise heavy metal contamination of soils.

[3]

[Total: 16]

5 Describe the components of an artesian basin and its structure. Describe how drinking water can be extracted from artesian basins. You may draw diagrams to help explain your answer.



[8]

[Total: 8]

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.

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