OCR
Oxford Cambridge and RSA

Monday 8 June 2015 – Morning

A2 GCE GEOLOGY

F794/01 Environmental Geology

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. 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 pages at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

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.
- This document consists of **16** pages. Any blank pages are indicated.

Answer **all** the questions.

1 (a) (i) Describe the difference between the terms **surface water** and **groundwater** when used in the context of drinking water supply.

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..... **[2]**

(ii) Describe **one** advantage and **one** disadvantage of using groundwater for drinking water supply.

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..... **[2]**

(iii) Describe how groundwater resources can be renewable and sustainable if carefully managed.

renewable .....

.....

sustainable .....

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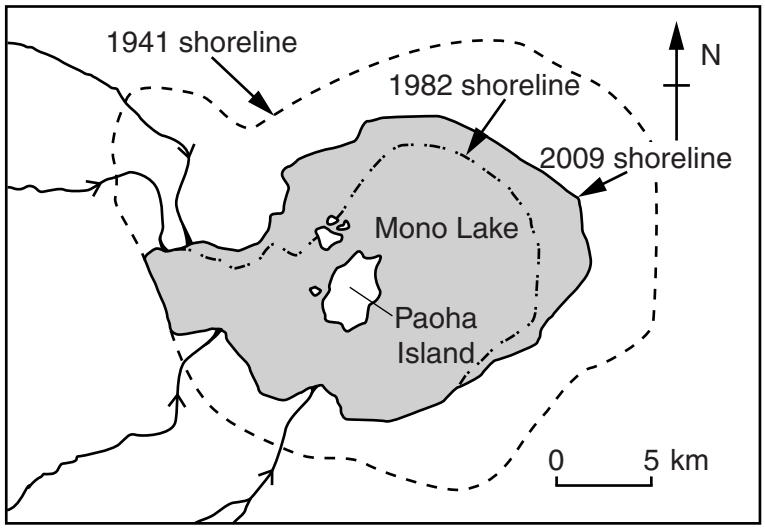
[2]

(b) Study the information below about Mono Lake in California, USA.

The Mono Lake is an important source of water in California. In 1941, streams flowing into Mono Lake were diverted to supply water to Los Angeles. The lake reached its lowest level in 1982. In 1994, a water management plan was implemented to restrict the water diversions in an attempt to stabilise the water level in the lake.



Date	Water level in lake (metres above sea level)	Surface area of lake (km^2)	Salinity of lake water (g/l)
1919	1959	233	42.0
1941	1956	222	51.3
1982	1942	153	99.4
2009	1945	183	79.6

(i) Use data from the table above to calculate the percentage change in the surface area of Mono Lake between 1941 and 1982.

..... % **[1]**

(ii) Describe and explain the relationship between the water level and salinity in Mono Lake.

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..... **[2]**

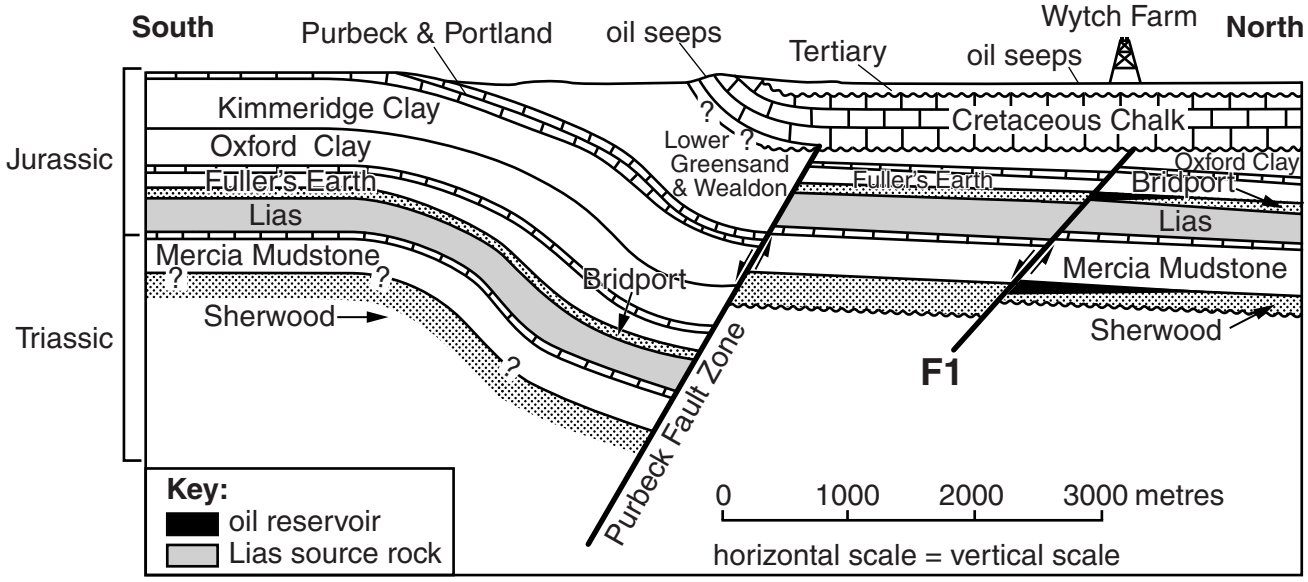
(iii) Every summer, Mono Lake shrinks and the sediments around the lake dry out. Name the sedimentary structure that forms in the sediments as a result.

..... **[1]**

[Total: 10]

2 **(a)** Study the information below, about Wytch Farm oilfield in Dorset.

Wytch Farm is Europe's largest onshore oilfield. The oilfield is in a designated Area of Outstanding Natural Beauty. When the oilfield was put into production in 1979, estimated reserves were 480 million barrels of oil. Peak oil production was 110 000 barrels per day in 1997 and oil production was 15 000 barrels per day in 2011. The oilfield consists of three separate reservoirs: Sherwood, Bridport and Frome (not shown on cross-section). The main source rock is the Jurassic Lower Lias. From an onshore wellhead, extended reach drilling technology was pioneered to drill horizontal production wells into the Sherwood reservoir under the sea.



(i) Define the term *reserves*.

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..... **[1]**

(ii) Describe the difficulties in accurately determining reserves in an oilfield.

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..... **[2]**

(iii) Suggest why oil production at Wytch Farm changed from 110 000 barrels per day in 1997 to 15 000 barrels per day in 2011.

.....

..... **[1]**

(iv) Assess and discuss the significance of the Purbeck Fault Zone and fault **F1** in relation to the accumulation of oil in the reservoir rocks and the oil seeps at the surface. Use information from the cross-section diagram of Wytch Farm in your answer.

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..... **[3]**

(b) (i) Rock samples from each of the Wytch Farm oil reservoirs were obtained by drilling. Use the descriptions in the table below to identify these rocks. Write your answers in the table.

Reservoir	Rock sample description	Full name of rock
Sherwood	• pink colour • medium grain size, less than 15% matrix • composed mainly of quartz with 40% K feldspar, plus rock fragments and mica	
Bridport	• yellow / grey colour • medium grain size, well sorted • composed of 95% quartz, with a small amount of calcite cement	
Frome (not shown on cross-section)	• grey colour, massive beds • composed of 90% calcite mainly in the form of broken oyster shells, with 10% clay	

[3]

(ii) Name and explain the **two** key properties these rocks require to be good reservoir rocks for oil.

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

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..... **[2]**

(c) Suggest why extended reach drilling technology was used to extract oil from beneath the sea.

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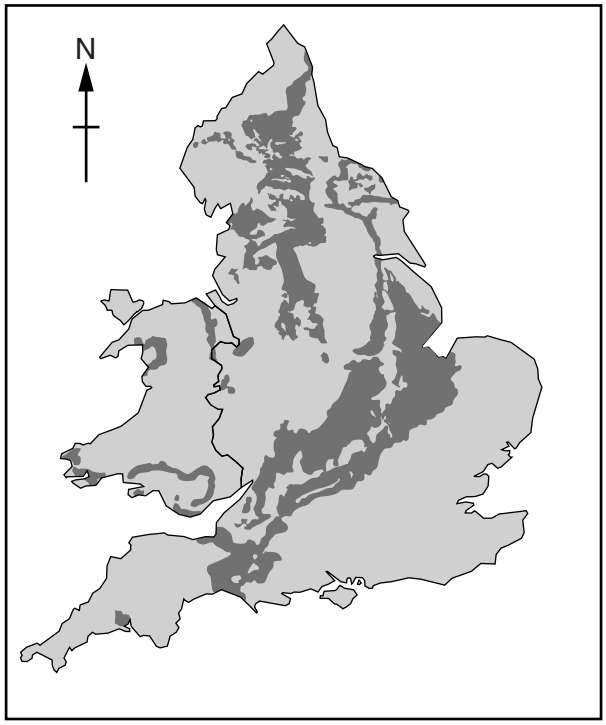
..... **[1]**

(d) Oil shales contain unconventional sources of petroleum. The map below shows the location of shale deposits in England and Wales that have the potential to yield hydrocarbons.



(i) Describe fully the composition and characteristics of an oil shale.

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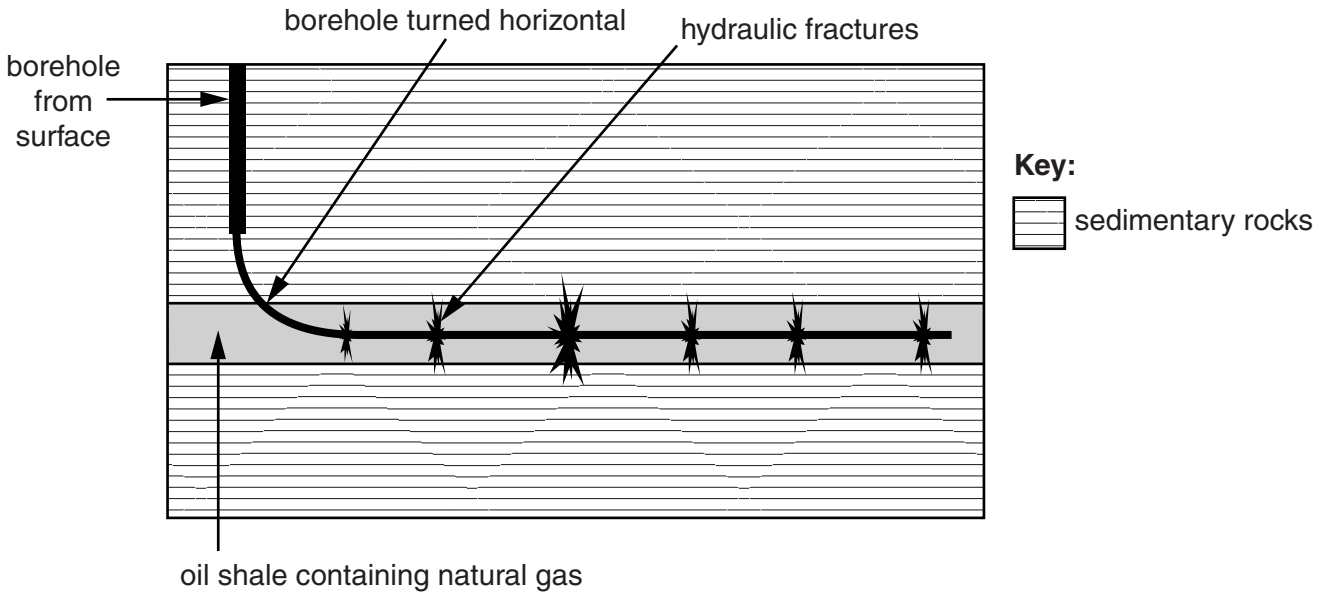
..... **[2]**

(ii) Hydraulic fracturing ('fracking') is one way of extracting hydrocarbons from oil shale.

The cross-section diagram below shows how fracking is carried out using horizontal drilling developed from extended reach drilling technology. A water-based fluid is pumped into the borehole at high pressure to fracture the rocks and release natural gas. Production wells then extract the natural gas.



There has been opposition to fracking on environmental grounds.

Describe the possible environmental and structural consequences of using fracking to extract natural gas from oil shale.

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..... **[2]**

(iii) Explain why, despite environmental opposition, the extraction of petroleum from unconventional sources is likely to increase in the future.

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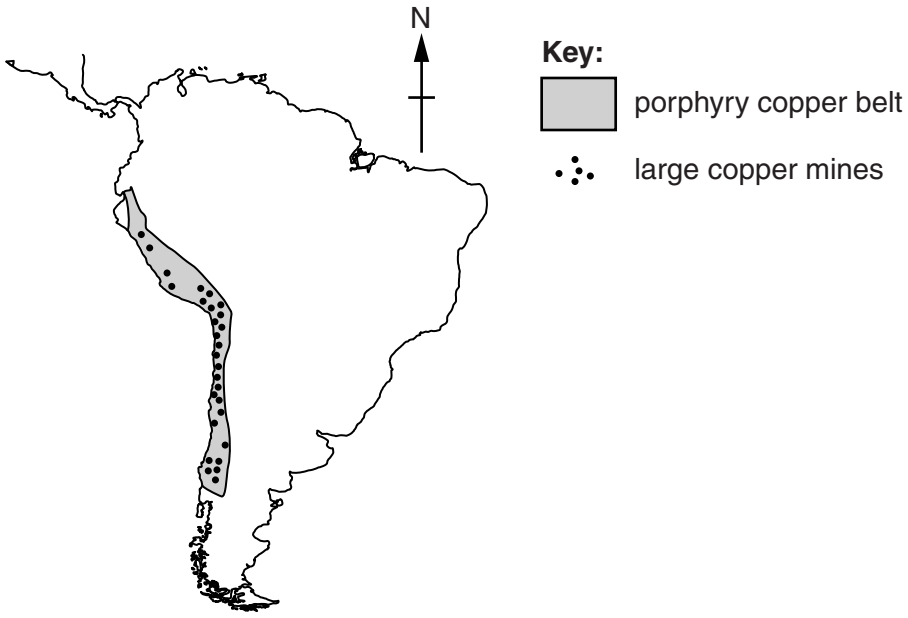
..... **[2]**

[Total: 19]

3 **(a)** The map below shows the distribution of hydrothermal porphyry copper deposits in South America.



(i) State the type of plate margin at the western side of South America.

..... **[1]**

(ii) Use your knowledge of geological processes at this type of plate margin to explain why there are porphyry copper and other hydrothermal ore deposits in South America.

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..... **[3]**

(b) Many porphyry copper deposits have undergone secondary enrichment. The table below shows data from one porphyry copper deposit.

	Average % of copper
continental crust	0.007
primary copper ore	0.5
zone of secondary enrichment	3.5

(i) Use the data in the table to calculate the concentration factors for the primary copper ore and the zone of secondary enrichment.

concentration factor for primary copper ore .....

concentration factor for zone of secondary enrichment ..... **[1]**

(ii) Describe and explain how copper deposits undergo secondary enrichment.

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..... **[3]**

(iii) Why is the process of secondary enrichment important to the economics of a copper mining operation?

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..... **[1]**

(c) Explain why placer deposits of gold form in rivers.

Draw a labelled diagram to illustrate one site of deposition.

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..... **[3]**

[Total: 12]

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Please turn to page 12 for Question 4

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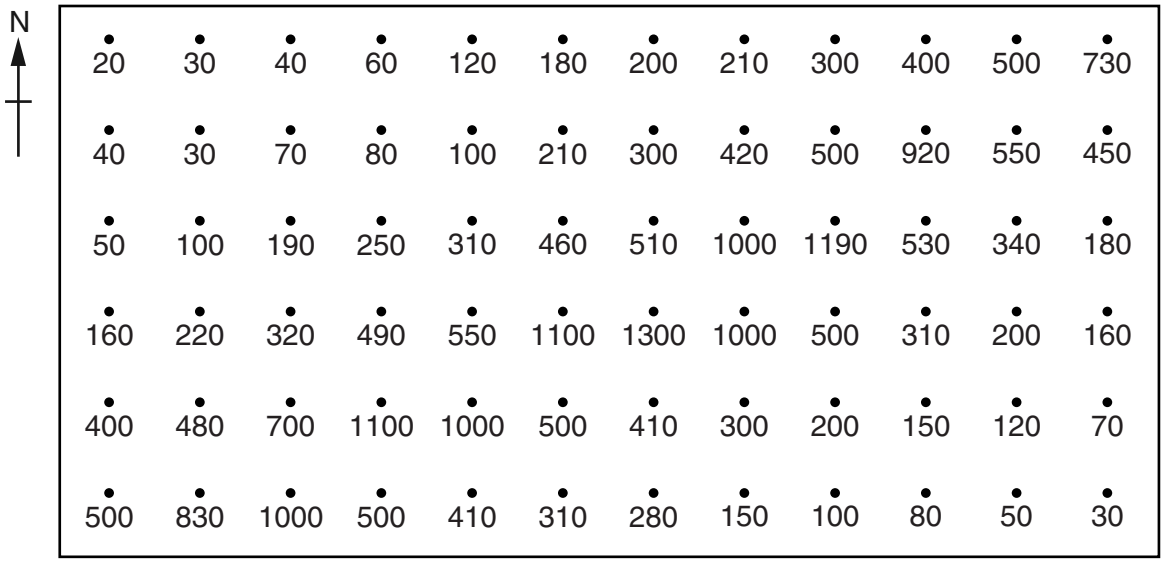
4 Geochemical surveys can be used in the initial stages of exploration for metallic mineral deposits.

(a) Soil samples were collected from a small flat area as part of a metallic mineral exploration programme. The results of chemical analyses for copper in parts per million (ppm) are plotted on the map below.



(i) Draw 300, 500 and 1000 ppm isolines to show the distribution of copper in the soil. **[2]**

(ii) Describe how the copper was dispersed into the soil.

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..... **[1]**

(iii) Describe the pattern of distribution of copper in the soil. Explain how underlying geological structures may have controlled this pattern.

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..... **[2]**

(iv) Shade the area on the map where you would drill exploration boreholes in the second stage of exploration to ascertain whether or not there are economic quantities of copper present in the underlying rocks. Explain your choice of area.

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..... **[2]**

(b) Describe how the results of soil geochemical surveys can be used to identify environmental problems.

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..... **[2]**

(c) Discuss the long-term environmental consequences of the legacy of metal mining in the British Isles.

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..... **[2]**

[Total: 11]

Question 5 begins on page 14

5 Describe and explain **four** methods that can be used to prevent coastal erosion.

You may use diagrams to illustrate your answer.

.... [8]

[Total: 8]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin.