OCR
Oxford Cambridge and RSA

Monday 6 June 2016 – Afternoon

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 page(s) 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)** An aquifer used for groundwater supply has the following features:

- the aquifer is confined between impermeable rocks
- parts of the aquifer outcrop on the surface
- the aquifer is in the form of a geological structure.

(i) Suggest a suitable geological structure for the aquifer.

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

(ii) Use the information above to draw a fully labelled cross-section diagram to show this aquifer. You should include:

- the ground surface and recharge zone(s)
- the rocks above and below the aquifer
- the water table.

[3]

(iii) A rock sample taken from an aquifer has a dry mass of 431.4 g. The rock sample has a mass of 487.1 g when saturated with water.

Calculate the percentage porosity of the rock.

Percentage porosity ..... % **[1]**

(b) (i) A rock sample from a different aquifer has a percentage porosity of 18.3% and a volume of 160 cm^3.

Calculate the volume of the pore space in this rock.

Volume of pore space ..... cm^3 **[1]**

(ii) What rock type could the sample from this aquifer be? Give a reason for your answer.

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

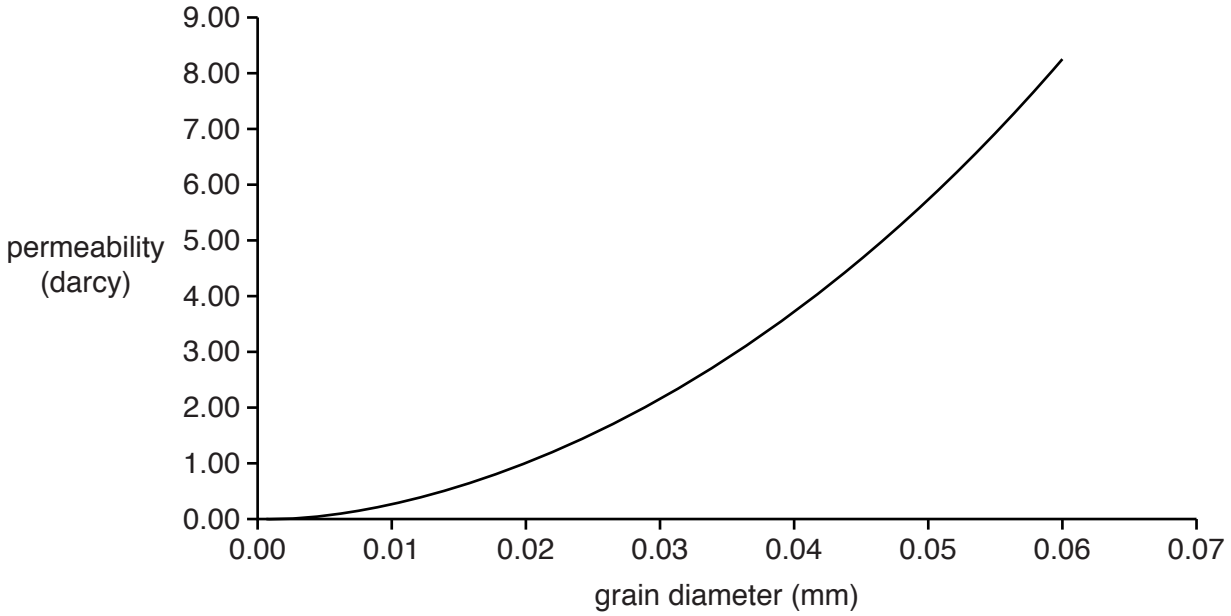
(c) Define the term *aquiclude*.

.....

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

Question 1(d) begins on page 4

(d) Study the graph below.



(i) Use the graph to describe the relationship between grain diameter and permeability. Explain this relationship.

Description .....

.....

Explanation .....

.....

[2]

(ii) Name a rock that can be permeable but **not** porous. Give a reason for your answer.

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

(e) Explain why hydrogeologists require data about the porosity and permeability of rocks in an aquifer.

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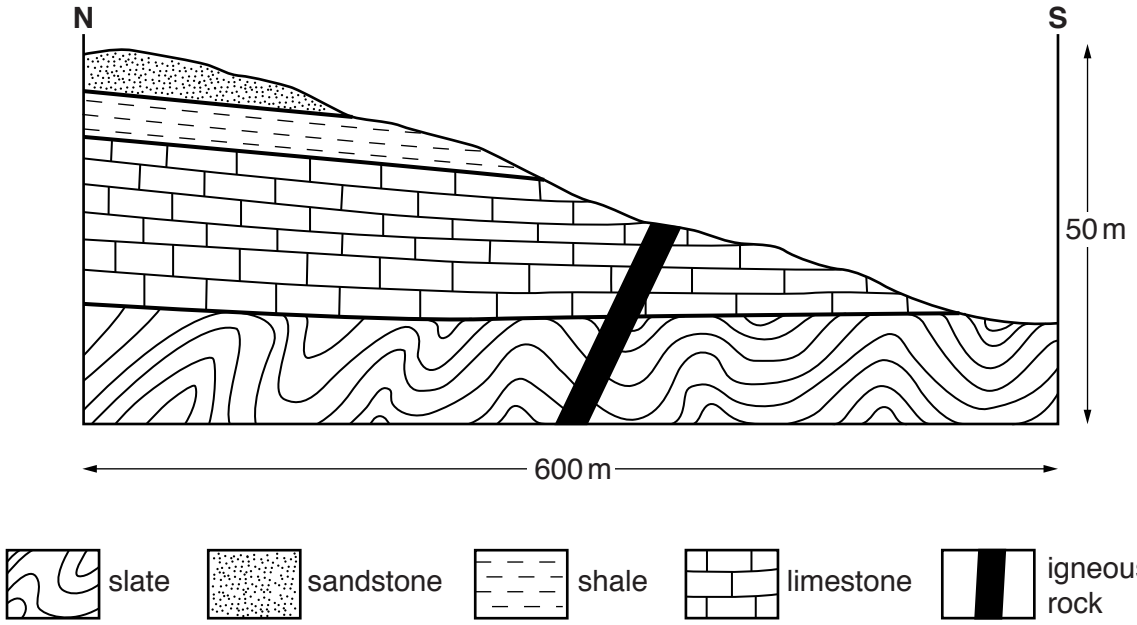
..... **[2]**

(f) Study the geological cross-section through the hillside shown below.



(i) Draw arrows on the cross-section to show **three** different geological locations where springs could occur. **[2]**

(ii) Describe the geological conditions that would lead to the formation of these springs.

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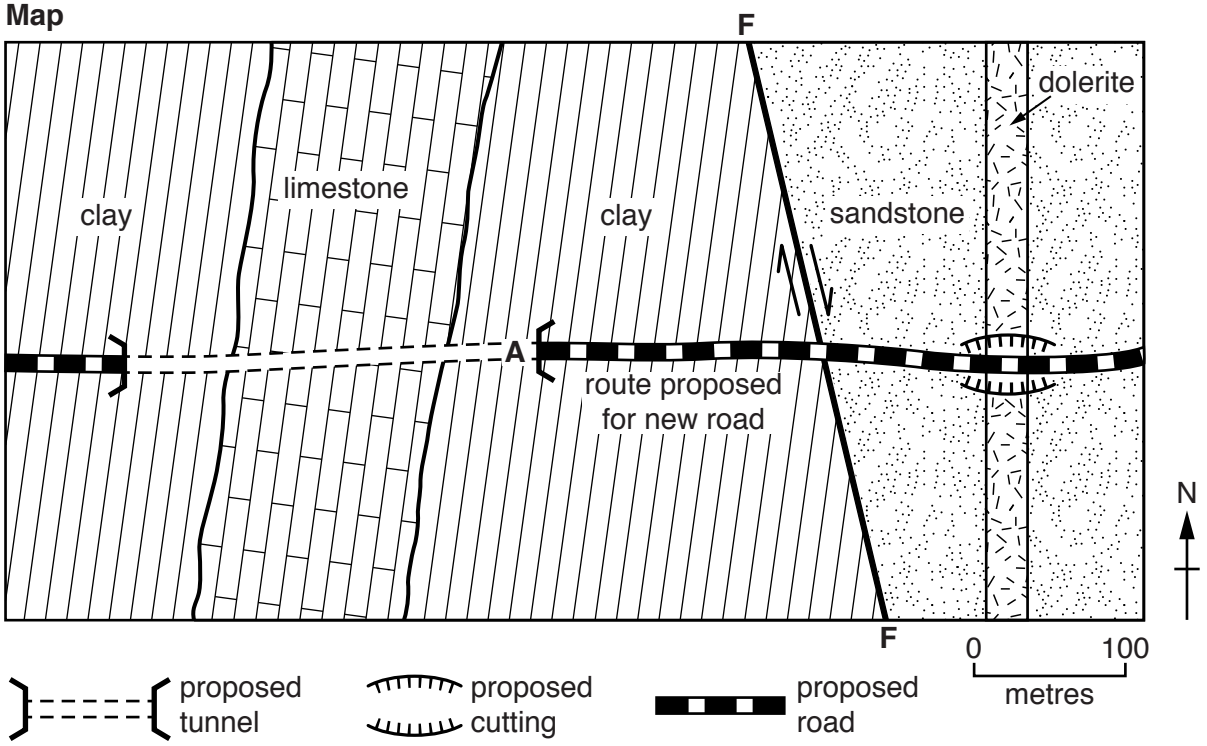
..... **[2]**

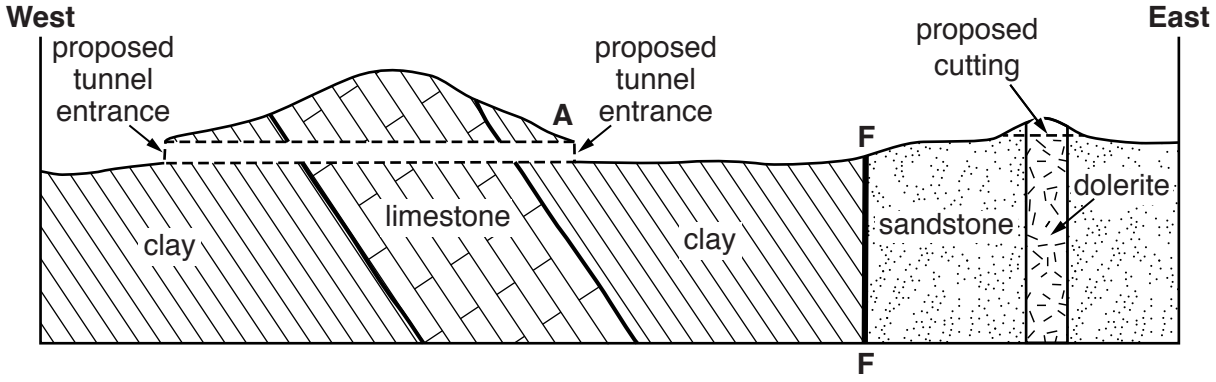
[Total: 17]

2 The geological map and cross-section below show the route proposed for a new road.

Map



Cross-section



(a) (i) Give **two** geological reasons why there will be a risk of slope failure at point **A** above the eastern portal of the tunnel.

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

(ii) Name and explain **one** ground improvement strategy that could be used to reduce the risk of slope failure.

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

(iii) Describe and explain **one** other geological problem that could occur in the eastern half of the area if the road was built along the proposed route.

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

(b) (i) What name is given to unconsolidated construction materials of sand size and above which can be used for roadstone?

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

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

(ii) Local rock will be used for the roadstone.

Assess the suitability of dolerite, limestone and sandstone for roadstone.
Use your knowledge of the characteristics of each rock type to support your answer.

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

[Total: 9]

3 **(a)** **(i)** Compare the nature of the organic matter required for the formation of coal **and** oil.

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

(ii) Compare **and** contrast the environments of deposition for the formation of coal **and** oil.

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.....

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

(b) As coal forms, it undergoes a series of physical and chemical changes as the rank increases.

(i) State **two** physical and **two** chemical differences between bituminous coal and anthracite.

Physical differences .....

.....

Chemical differences .....

.....

[2]

(ii) Name and describe the process that causes these physical and chemical changes as the rank increases.

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

(c) **(i)** Describe a *source rock* for oil.

.....

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

(ii) What name is given to the process that produces hydrocarbons in a source rock?

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

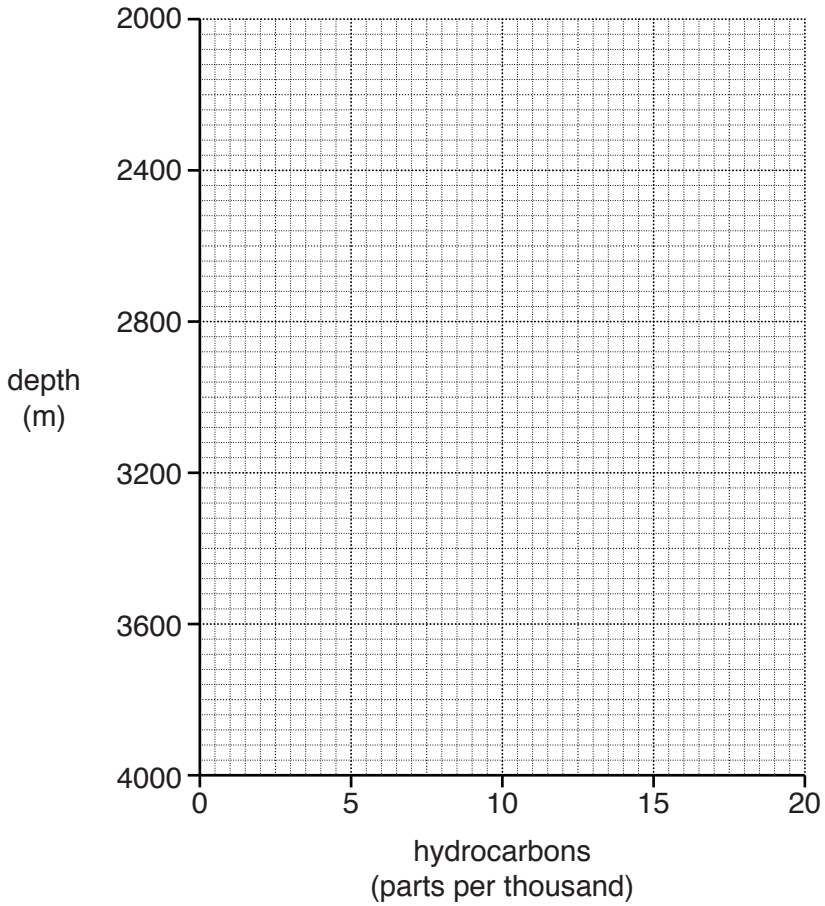
..... **[1]**

(iii) The table below shows the amount of hydrocarbons found between the depths of 2200 and 4000 metres in the Green River Formation black shale, Utah, USA.

Depth (m)	Hydrocarbons (parts per thousand)
2200	0
2400	0
2600	1
2800	7
3000	15

Depth (m)	Hydrocarbons (parts per thousand)
3200	17
3400	12
3600	2
3800	1
4000	0

Use the data from the table to plot a line graph on the grid below.



[2]

(iv) State the depth for the peak of hydrocarbon formation.

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

(v) If the geothermal gradient is 30 °C/km, calculate the temperature for the peak of hydrocarbon formation. Assume the surface temperature is 15 °C.

Temperature ..... °C **[1]**

(d) Explain why oil is usually found in rocks closer to the surface than the source rock.

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

(e) State the origin of the natural gas in the southern basin of the North Sea.

Explain how the natural gas accumulated to form economic deposits.

Origin .....

Explanation .....

.....

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[2]

[Total: 17]

4 Hydroelectric, geothermal and nuclear energy resources can be used as alternatives to fossil fuels.

(a) Describe **one** environmental and **one** social consequence of using dams and reservoirs for hydroelectric power generation.

Environmental consequence .....

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Social consequence .....

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[2]

(b) Discuss the feasibility of extracting geothermal energy in the British Isles.

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

(c) Uranium is the energy source for nuclear power.

(i) Describe and explain how deposits of uranium ore form in sandstones.

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

(ii) Describe and explain the geological factors that should be considered when evaluating an area for the long-term safe storage of nuclear waste in an underground repository in rocks.

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

[Total: 9]

5 Describe how metallic mineral deposits can form as a result of igneous processes in mafic (gabbro) intrusions **and** in and around intrusions of silicic (granite) composition.

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(s).