

Surname	Centre Number	Candidate Number
First name(s)		2



GCE A LEVEL

A480U10-1



O21-A480U10-1



Part of WJEC

TUESDAY, 5 OCTOBER 2021 – AFTERNOON

GEOLOGY – A level component 1
Geological Investigations

2 hours 15 minutes

ADDITIONAL MATERIALS

In addition to this examination paper, you will need:

- the Resource Sheet
- **Specimens B, C, D and M**
- geological equipment for testing specimens
- the Mineral Data Sheet
- a calculator
- a protractor
- a ruler

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid. You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

If you run out of space, use the additional page(s) at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

This paper is in 2 sections, **A** and **B**.

Section **A**: 30 marks. Answer **both** questions. You are advised to spend about 35 minutes on this section.

Section **B**: 75 marks. Answer **all** questions. You are advised to spend about 1 hour 40 minutes on this section.

The geology is **not** designed to represent any particular area.

The Mineral Data Sheet and **Map 1** and **Photographs 1, 2, 3 and 4** are provided on separate resource sheets.

Strips of plain paper may be obtained from the supervisor on request.

Four specimens, **B, C, D** and **M** are provided for use.

The number of marks is given in brackets at the end of each question or part-question.

The assessment of the quality of extended response (QER) will take place in questions **2** and **6**.

For Examiner's use only			
	Question	Maximum Mark	Mark Awarded
Section A	1.	16	
	2.	14	
Section B	3.	9	
	4.	7	
	5.	10	
	6.	16	
	7.	14	
	8.	14	
	9.	5	
Total		105	

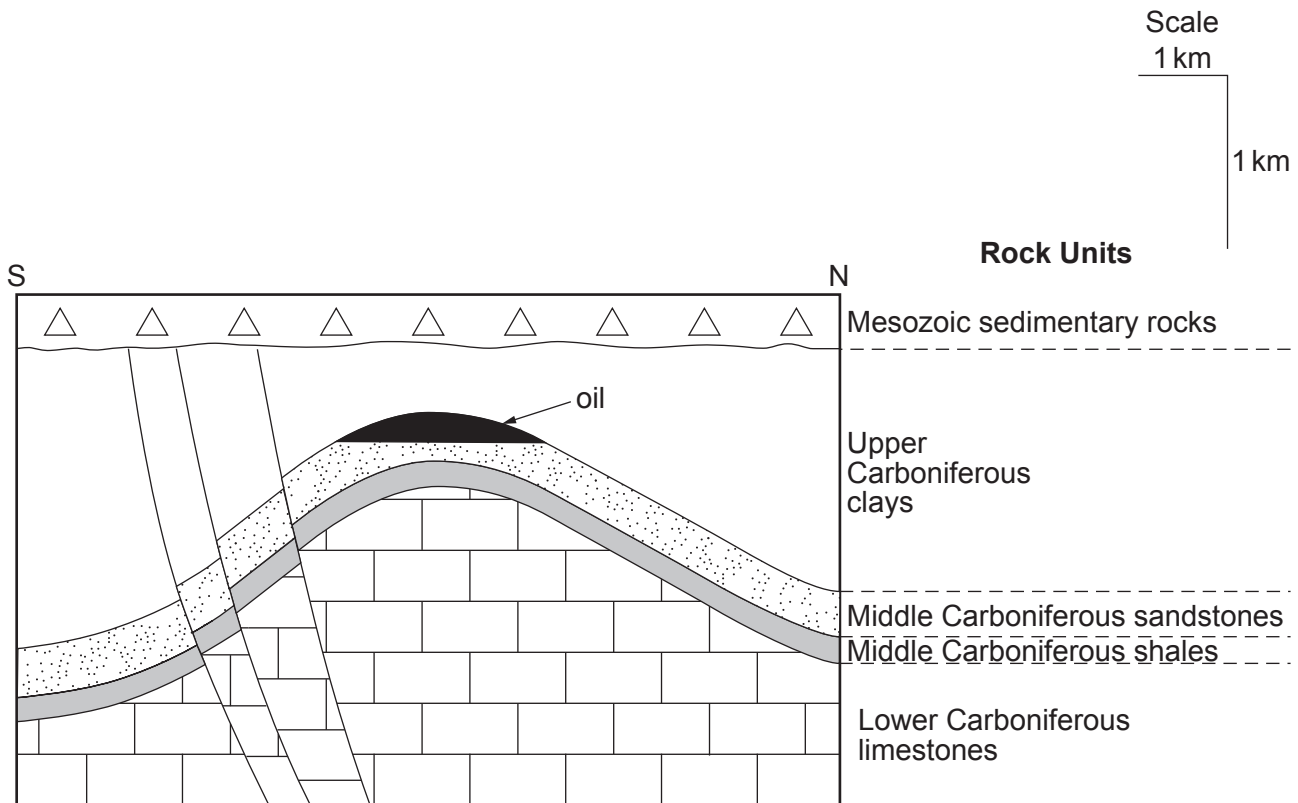
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SECTION A*Answer all questions.*

1. **Figure 1a** is a cross-section through the Eakring oil field in Eastern England.

**Figure 1a**

Refer to **Figure 1a**.

- (a) **Table 1** below shows the features of the Eakring oil field. Complete **Table 1** by stating the **rock units** that act as the source, reservoir and cap rock and by identifying the type of oil trap present. [4]

Feature of the oil field	Eakring oil field
Source rock	•
Reservoir rock	•
Cap rock	•
Type of trap	•

Table 1

- (b) Explain why microfossils are used for correlation when prospecting for hydrocarbon fields such as Eakring. [3]

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- (c) **Figure 1b** shows a simulation to investigate the hydraulic conductivity of the Middle Carboniferous sandstones.

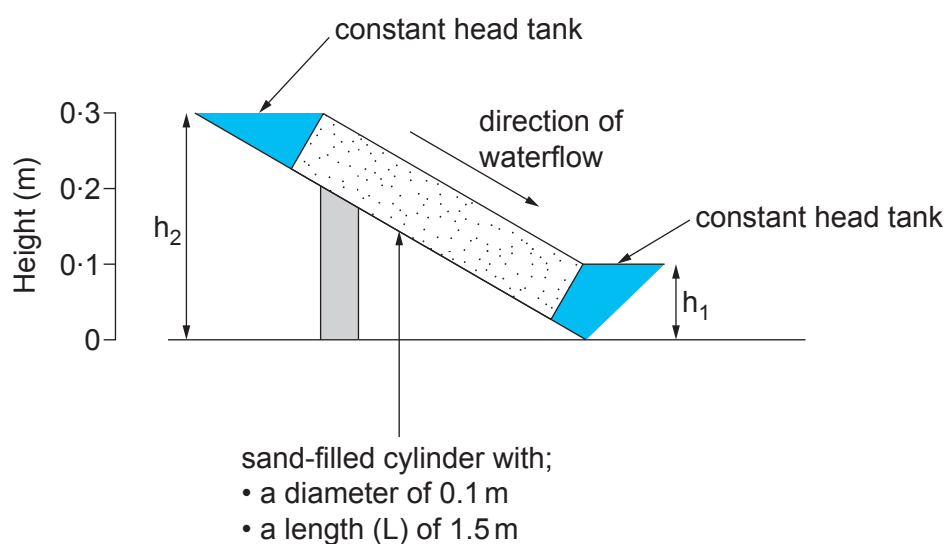


Figure 1b

- (i) Complete **Table 2** below to show the values of;
- h_1
 - h_2
 - the cross-sectional area of the cylinder (show your working for this calculation) [3]

h_1	•
h_2	•
Cross-sectional area of the cylinder (A)	•
Flow rate (Q)	$4 \times 10^{-4} \text{ m}^3 \text{ s}^{-1}$

Table 2



- (ii) Using the equation below, calculate the hydraulic conductivity (k) of the sand used in the experiment. Show your working. [3]

$$Q = kA \left(\frac{h_2 - h_1}{L} \right)$$

Answer	Units
•	m s^{-1}

- (iii) Refer to **Figure 1a** and **Figure 1b**. Explain why the hydraulic conductivity of the Middle Carboniferous sandstones is likely to differ from the value calculated for the sand in the simulation. [3]

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2. **Figure 2** shows the variations in mean global temperature and atmospheric CO₂ levels during the last 20,000 years.

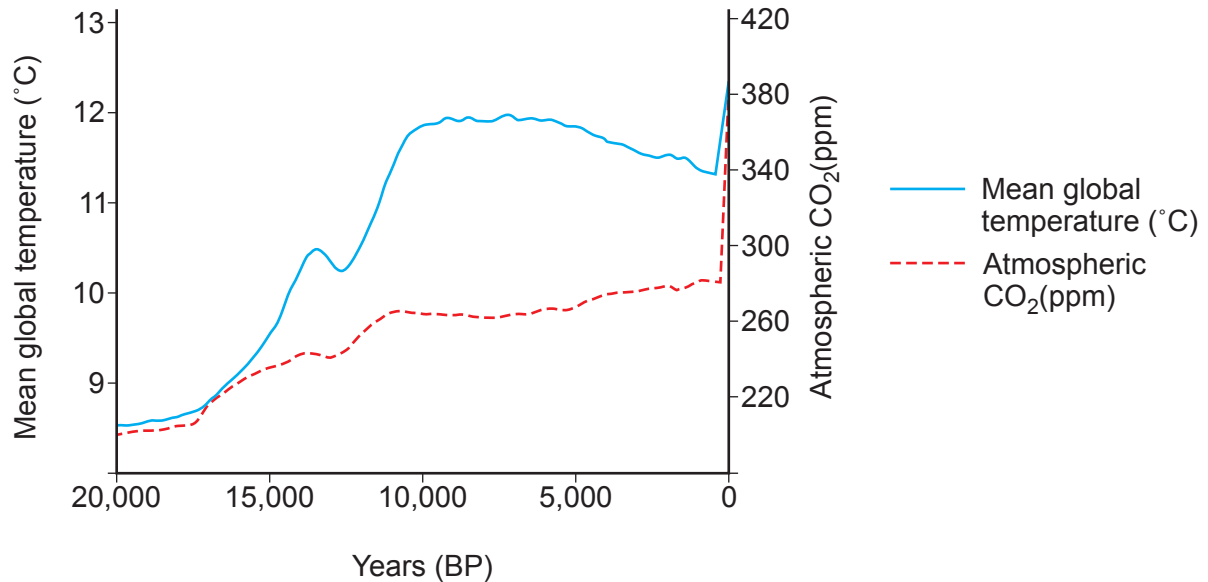


Figure 2

Refer to **Figure 2**.

- (a) (i) Describe the temperature changes shown in **Figure 2**.

[3]

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- (ii) A student stated;

"increased CO₂ levels always lead to increased global temperatures."

Evaluate this statement with reference to **Figure 2**.

[3]

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- Evaluate the effectiveness of each of these markers in defining the start of the Anthropocene. [6 QER]



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SECTION B

Answer all questions.

3. **Specimen D** is a plaster cast representing a fossil found in **Rock Unit D** on **Map 1**.

(a) (i) In the space below, draw a scaled diagram of **Specimen D**.

[4]

(ii) Label the cephalon on your diagram.

[1]

(b) Suggest, giving reasons, the most likely mode of life of the fossil represented by **Specimen D**.

[3]

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(c) Identify the fossil represented by **Specimen D** using the key below. [1]

- | | |
|---|--|
| 1. Does it have genal spines longer than 5 mm? | Yes go to 2
No go to 3 |
| 2. Are the genal spines longer than the thorax? | Yes = <i>Trinucleus</i>
No = <i>Bellacartwrightia</i> |
| 3. Is the pygidium larger than the thorax? | Yes = <i>Agnostus</i>
No go to 4 |
| 4. Does it have crescent shaped eyes? | Yes go to 5
No = <i>Deiphon</i> |
| 5. Is the pygidium made up of segments? | Yes = <i>Calymene</i>
No = <i>Isotelus</i> |

Specimen D is



4. **Specimen B** is representative of **Rock Unit B** on **Map 1**.
Photograph 1 on the Resource Sheet was taken at **Locality I** on **Map 1** and shows the upper surface of **Rock Unit B**.

(a) Describe the texture and composition of **Specimen B**. [2]

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(b) Identify the structure shown in **Photograph 1**. [1]

.....

(c) State the type of igneous body represented by **Rock Unit B**. Explain **one** piece of evidence from each of;

- **Specimen B**
- **Photograph 1**
- **Map 1**

[4]

Type of igneous body

Evidence from **Specimen B**

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Evidence from **Photograph 1**

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Evidence from **Map 1**

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5. **Photograph 2** on the Resource Sheet was taken at **Locality II** on **Map 1** looking towards a bearing of **005°**. **Specimen M** and **Specimen C** were collected from **Rock Units M** and **C** on **Map 1**.

(a) In the space below draw a scaled, annotated sketch to show the key geological features in **Photograph 2**. [4]

(b) Describe the rock cycle processes that have resulted in the formation of;

- **Specimen C**
- **Specimen M**

[6]

Specimen C

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Specimen M

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6. **Photograph 3** on the Resource Sheet is a photomicrograph of **Rock Unit H** collected at **Locality III** on **Map 1**.

(a) Identify mineral **Y**. You may wish to refer to the Mineral Data Sheet. [1]

Mineral **Y**

(b) State, giving **two** reasons, the name of the rock forming **Rock Unit H**. [3]

Name of rock forming **Rock Unit H**

1

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2

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Photograph 4 on the Resource Sheet is a photomicrograph of **Rock Unit J** collected at **Locality IV** on **Map 1**.

(c) A student correctly interpreted that;

“Rock Unit J formed in a shallow, tropical, marine environment”.

Explain the evidence for this interpretation. [3]

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- You may wish to use an annotated diagram(s) in your answer: [9 QER]



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- (d) Describe the folding present in **Rock Units D and K** to the **north of Fault F1**. [3]

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- (e) **Fault F1** on **Map 1** is an inclined fault which shows dip-slip rather than strike-slip movement.

State the evidence from **Map 1** which shows **Fault F1** is;

- Inclined
- Shows dip-slip movement

[2]

Inclined

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Dip-slip movement

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- (f) Complete **Table 4** below showing the features of **Fault F2** on **Map 1**. [3]

Feature of the fault	Fault F2
Dip angle of fault plane	•
Type of fault (normal, reverse, thrust or strike-slip)	•
Evidence for fault type	•

Table 4

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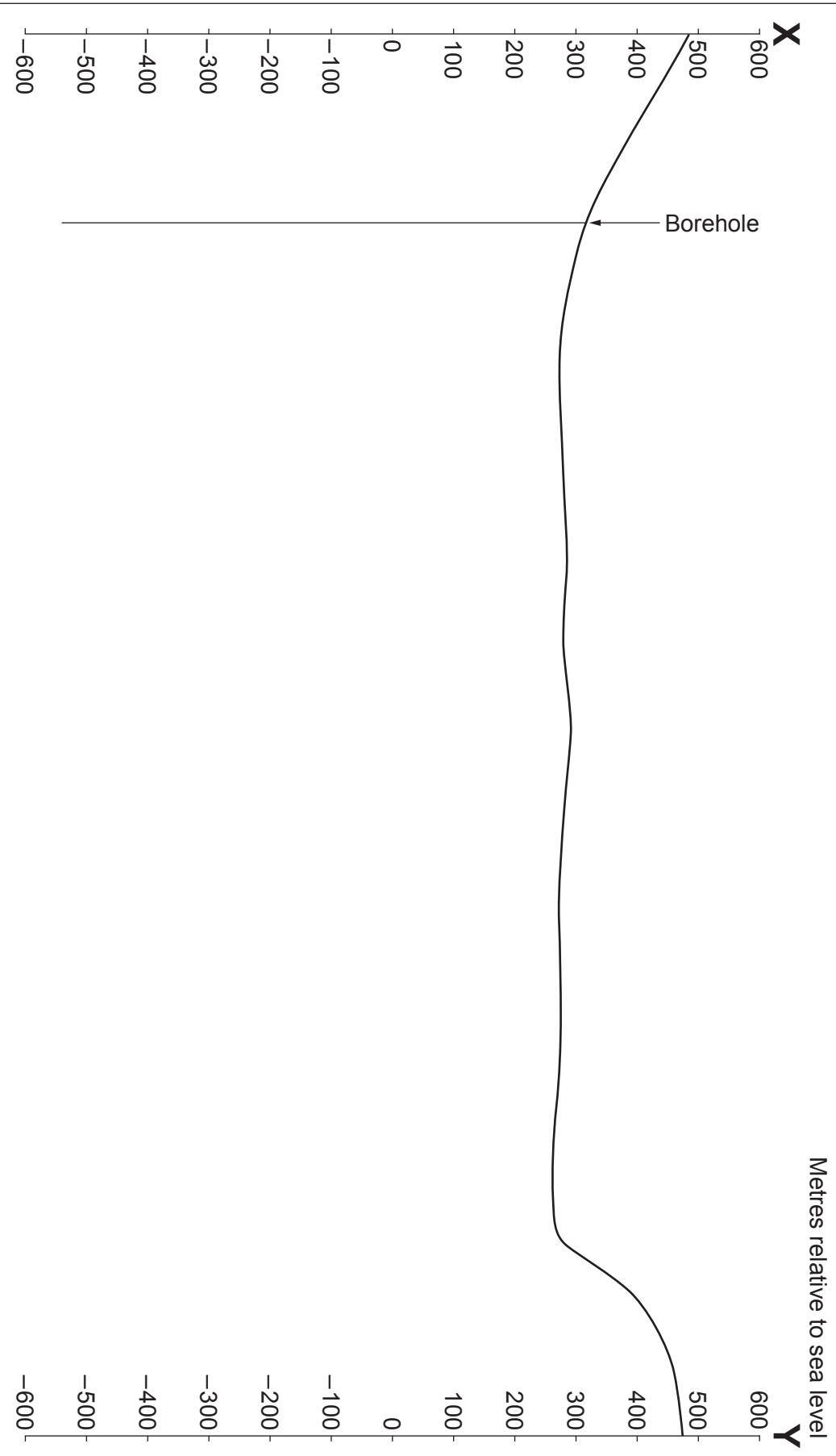


8. The topographic profile below was taken along the line **X–Y** on **Map 1**.

Complete the geological cross-section along this line using **Map 1** and the **borehole data** found in the key.

- Draw the rock units. Use similar ornament or letters as those used on **Map 1**
- Draw and label any **fold axes**
- Project the rock units and structures above the ground surface to illustrate any cross-cutting relationships.

[14]



9. **Table 5** below contains statements about the age relationships in **box B** on **Map 1**. Complete **Table 5** using evidence from **Map 1**, **Photograph 1** on the Resource Sheet and **Specimen B** to evaluate the age relationship statements shown in **Table 5**. State the evidence that supports each evaluation. [5]

Statement	Evaluation (correct, incorrect, insufficient evidence)	Evidence that supports the evaluation
Rock Unit E is younger than Rock Unit C and Rock Unit F .	correct	•
Rock Unit F is older than Rock Unit C .	incorrect	• •
The whole of Rock Unit G is younger than Rock Unit B .	•	•

Table 5

END OF PAPER

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Acknowledgements

Figure 1a adapted from Geology and Environment in Britain and Ireland, Woodcock
Figure 2 adapted from <https://roadsofstone.com/2007/03/06/140>



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