OCR
Oxford Cambridge and RSA

Thursday 19 June 2025 – Morning

A Level Geology

H414/03 Practical skills in geology

Time allowed: 1 hour 30 minutes

You must have:
- the Insert (inside this document)

You can use:
- an HB pencil
- a scientific or graphical calculator
- a protractor
- a ruler (cm/mm)
- A4 plain paper

H414/03

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **16** pages.

ADVICE
- Read each question carefully before you start your answer.

1

(a) **Fig. 1.1** in the **Insert** shows a thin section photograph of a carbonate rock.

(i) Name this rock using the Dunham classification scheme.

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

(ii) Calculate the magnification of the thin section photograph.

Magnification = ... **[2]**

(iii) Describe the environment in which the carbonate rock in **Fig. 1.1** in the **Insert** was deposited.

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(iv) Explain how the carbonate rock in **Fig. 1.1** in the **Insert** was formed.

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

(b) **Fig. 1.2** in the **Insert** shows a hand specimen of a metamorphic rock.

(i) Estimate the ratio of dark to light minerals in the metamorphic rock.

dark minerals: light minerals = 1: ..... **[1]**

(ii) Explain what the texture of the rock in **Fig. 1.2** suggests about the type and grade of metamorphism the rock has undergone.

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(c)* Use **Fig. 1.3** in the **Insert** to compare the composition and texture (including crystal size) of igneous rocks **A** and **B**.

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Extra answer space if required

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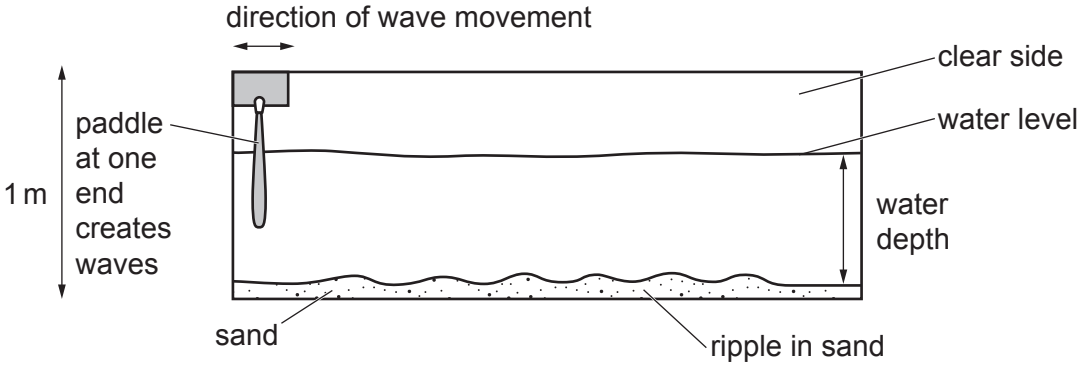
2 Some students visited a university to use a flume tank to investigate the formation of wave ripples. The diagram shows a cross-sectional view of the flume tank.



The students decided to investigate how water depth affects the wavelength of the wave ripples.

To do this the students:

- used a paddle at one end of the flume tank to generate waves which travelled through the water and created wave ripples in the sand on the bottom of the flume tank.
- used well-sorted sand with a grain size of 0.2 mm.
- ensured that the surface of the sand was flattened before each experiment.
- ran the flume tank for 30 minutes for each of the four different water depths.
- measured the wavelength of eight wave ripples for each water depth using a ruler.

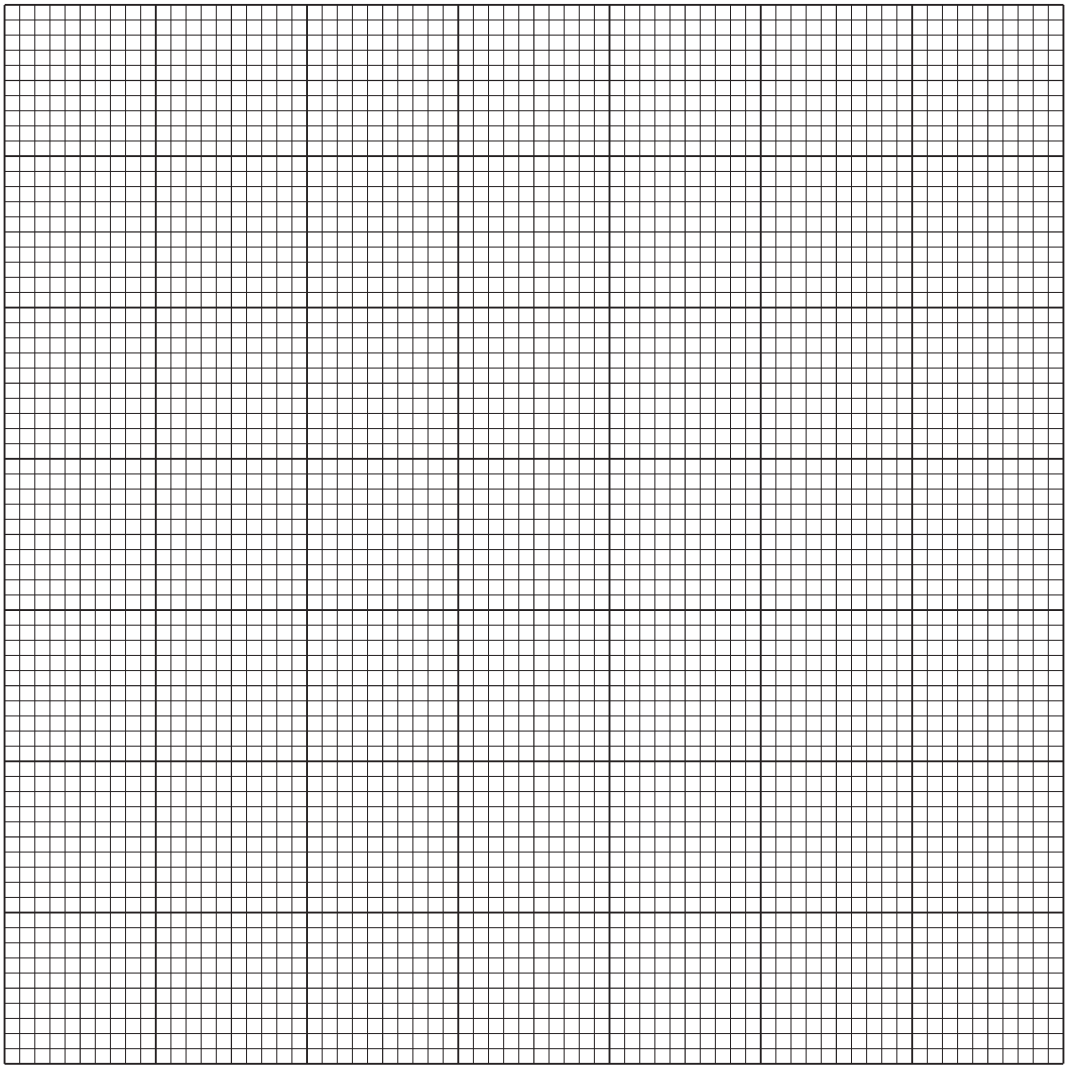
(a) The data collected by the students is shown in the table.

	Water depth			
	60 cm	**70 cm**	**80 cm**	**90 cm**
Wavelength (cm)	10.0	19.5	32.5	42.5
	11.0	19.5	31.0	45.0
	12.5	21.0	31.5	44.5
	11.0	20.5	30.0	47.0
	11.5	18.5	33.5	46.5
	12.0	22.0	29.5	45.0
	13.0	19.5	32.0	46.0
	12.5	20.0	30.5	44.5
Mean wavelength (cm)	11.69	20.06	31.31	45.13
Mean wavelength (cm) to 3 significant figures	11.7	20.1	31.3	.....
Median wavelength (cm)	11.75	19.75	31.25	.....

(i) At a water depth of 90 cm:
- State the mean wavelength (cm) to 3 significant figures.
- Calculate the median wavelength (cm).

Write your answers in the table. **[2]**

(ii) Plot a line graph to show the relationship between **mean wavelength** and **water depth** on the grid.



[3]

(iii) Describe the relationship between mean wavelength and water depth.

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

(iv) Suggest **one** variable that must be controlled when performing this series of experiments.

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

(b) The students went on a field trip to the outcrop of Jurassic sandstones shown in **Fig. 2.1** in the **Insert**.

Suggest how ripple marks on the sandstone bedding planes, such as those shown in **Fig. 2.1**, could be used to interpret the environment of deposition.

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(c) Design an experiment to investigate the formation of graded bedding.

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..... **[4]**

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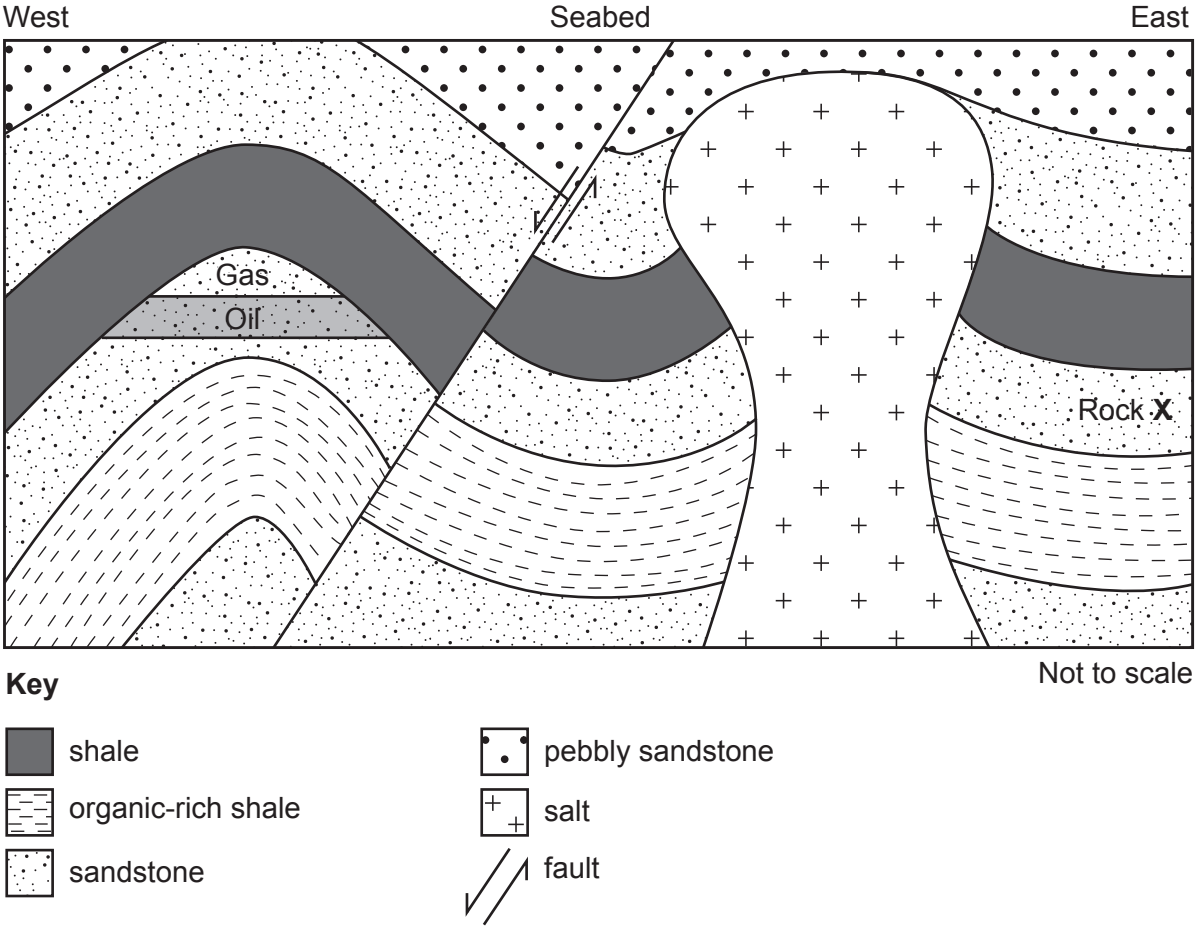
Turn over for the next question

3

(a) The diagram shows a cross-section in the North Sea across oil and gas-bearing strata and the location of one area of oil and gas.



(i) Explain why oil and gas are found at the location shown on the diagram.

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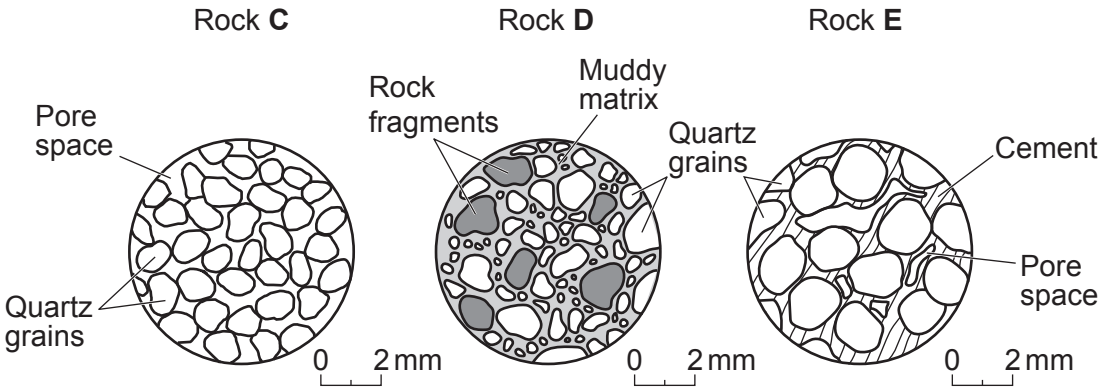
..... **[3]**

(ii) Draw on the diagram the positions where oil and gas may be found in **two** different geological situations. Label the names of these **two** different types of structural traps. **[2]**

(b) The thin section sketches show three different sedimentary rocks **C**, **D** and **E**.



(i) Explain why the porosity of the three sedimentary rocks **C**, **D** and **E** will vary.

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

(ii) Suggest which of the sedimentary rocks (**C**, **D** or **E**) is most likely to be Rock **X** on the cross-section diagram. Explain your answer.

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(iii) Suggest which of the sedimentary rocks (**C**, **D** or **E**) has been transported the shortest distance. Explain your answer.

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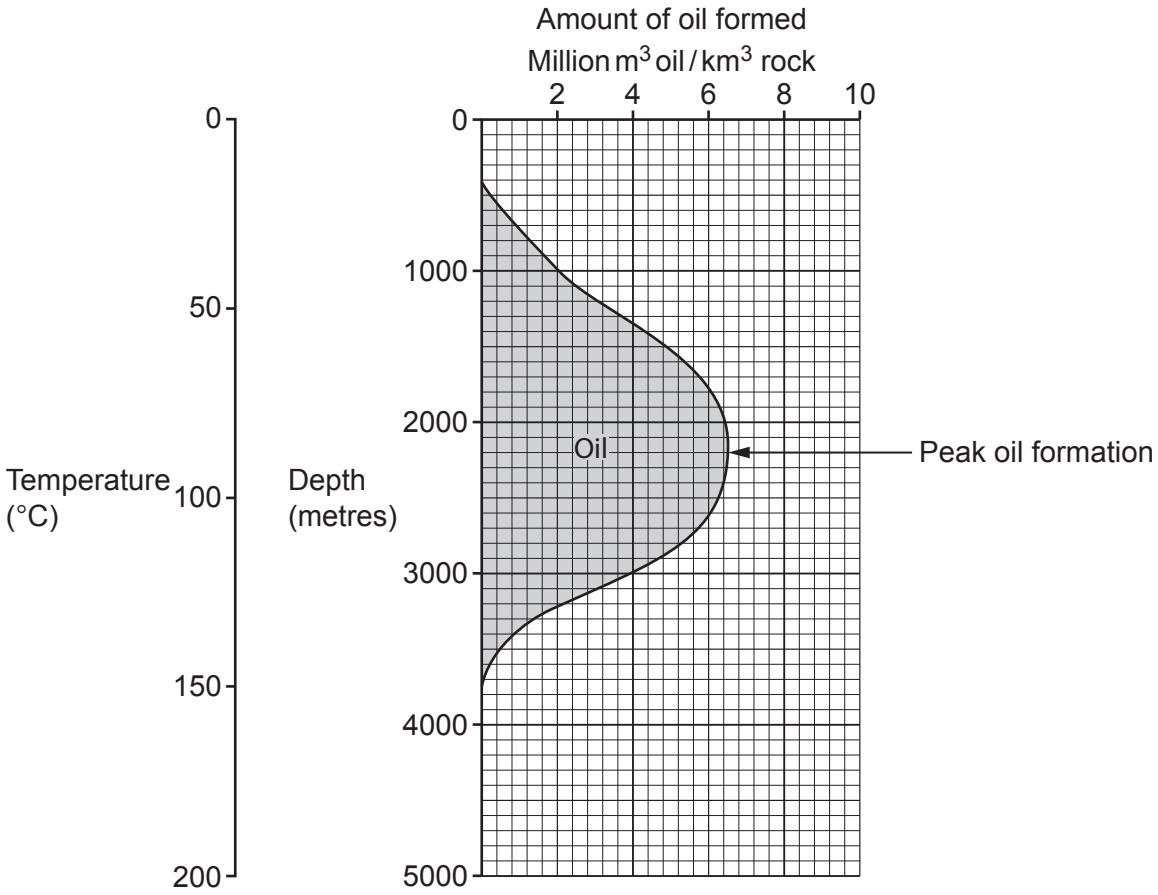
(c) The graph shows the **oil window** in a sedimentary basin.



(i) The geothermal gradient is the rate of change of temperature (ΔT) with depth (ΔZ). Calculate the geothermal gradient in this sedimentary basin. State the units.

Use the formula: geothermal gradient = $\frac{\Delta T}{\Delta Z}$

Where:
ΔT = change in temperature
ΔZ = change in depth

Geothermal gradient = ... Unit = ... **[2]**

(ii) Complete the sentence about peak oil formation. Use an option from the list.
decrease
increase
remain the same

The depth of peak oil formation would ..... in a sedimentary basin with a higher geothermal gradient. **[1]**

(d) Outline **one** ethical issue associated with the extraction of oil and gas.

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

4

(a)* Using **Fig. 4.1** in the **Insert**, explain how to use a compass clinometer to measure the dip and strike of a bedding plane.

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Extra answer space if required

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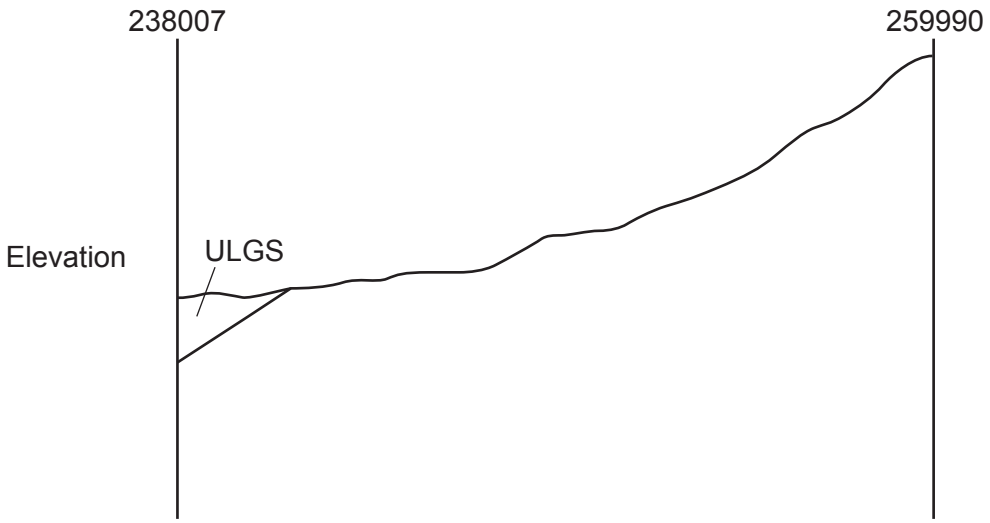
(b) The geological map excerpt (Carrick) **Fig. 4.2** in the **Insert**, should be used for this question.

(i) On the topographic sketch profile below, draw and label a cross-section of the solid geology from grid reference 238007 in the West to 259990 in the East. These grid references have been marked in yellow on the map.



[5]

(ii) Use **Fig. 4.2** in the **Insert** to calculate the maximum true thickness of the Silurian Protovirgularia Grits (PRO).

Maximum true thickness of Silurian Protovirgularia Grits (PRO) = ... m **[2]**

(iii) The Silurian Drumyork Flags (DYF) are overturned at grid reference 244993.

Describe **one** piece of fossil evidence that you would look for in the field to confirm that these sandstones are overturned. You may use a labelled diagram to explain your answer.

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

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.