OCR
Oxford Cambridge and RSA

Monday 17 June 2024 – Afternoon

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 _____

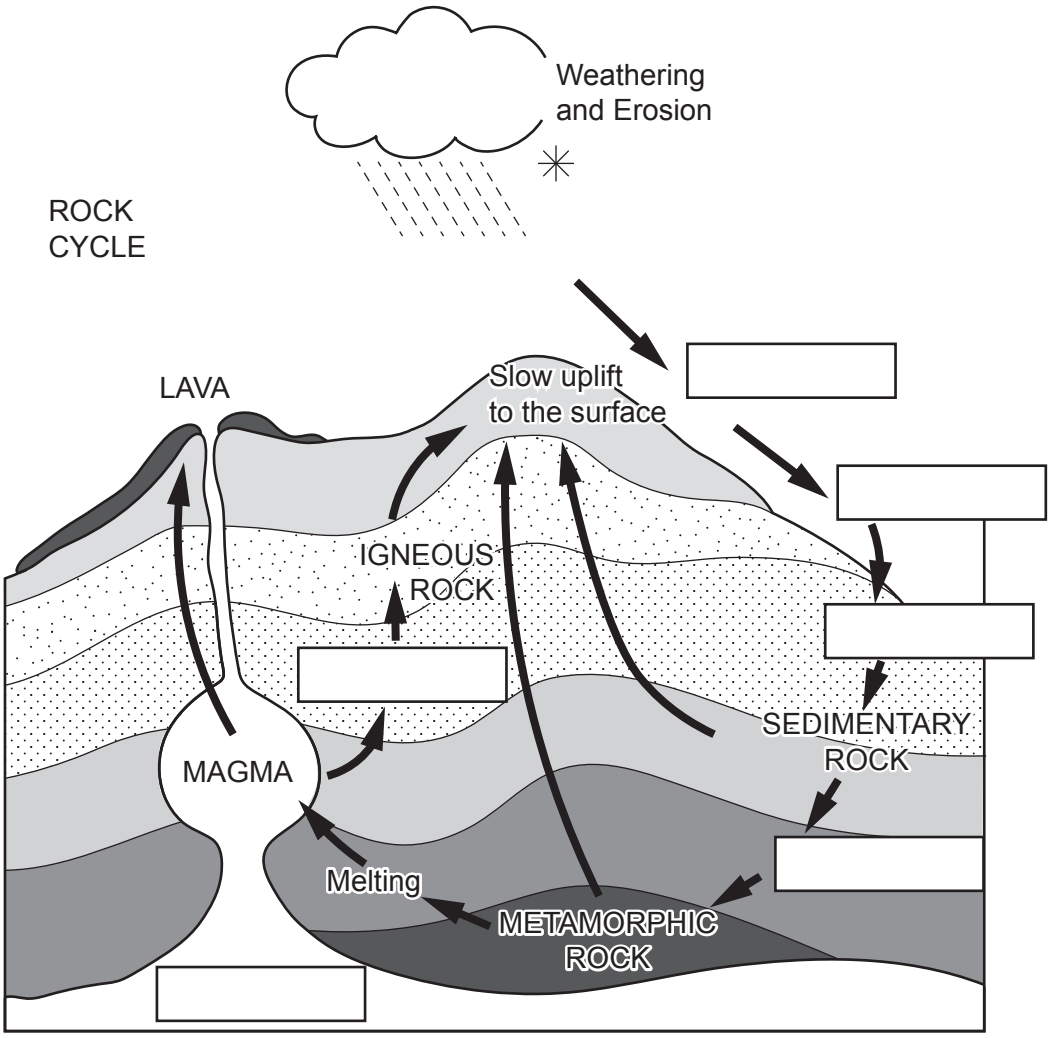
INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where 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) The diagram shows the rock cycle.



Use the processes in the table to complete the rock cycle diagram.

Write the correct letter **A**–**F** in the boxes on the diagram.

A	Burial, high temperatures and pressures	**B**	Compaction and cementation	**C**	Crystallisation of magma
D	Magma forms from molten crust and mantle	**E**	Sedimentation	**F**	Transport

[3]

(b) **Fig. 1**, in the **Insert**, shows photographs of three hand specimens of igneous rock.

(i) Use the photographs to complete the table.

	Rock A	**Rock B**	**Rock C**
Crystal size (fine/medium/coarse)			Not visible
Texture			
Colour			
Rock type			

[4]

(ii) Draw a labelled sketch that is representative of Rock **B**.

Include a suitable scale.

[3]

(iii) Compare and contrast the conditions of formation of Rocks **A** and **C**.

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(c)* **Fig. 2**, in the **Insert**, shows a sketch of a cross section through an area that has been intruded by an igneous body.

Explain how the information shown in **Fig. 2** provides evidence for the processes of the rock cycle. You should refer to relative dating principles and structure your answer to start with the earliest event.

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Extra answer space if required.

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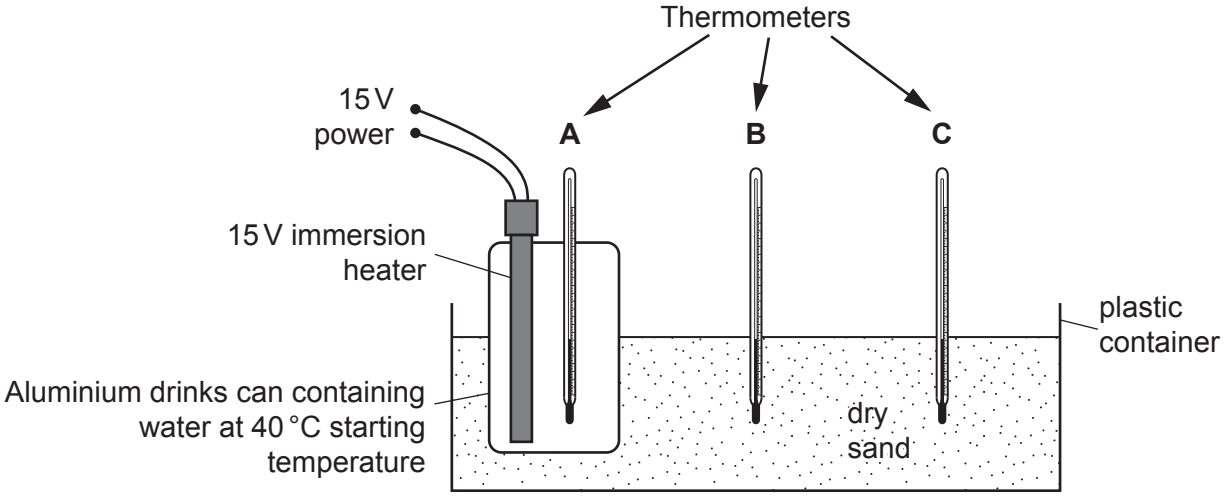
Turn over for the next question

2 A student carried out a practical exercise to simulate contact metamorphism. The diagram shows how their experiment was set up.



The experiment ran for 15 minutes. The temperature of each thermometer was recorded every 3 minutes. The results are shown in the table.

Time (minutes)	Temperature (°C)		
	Thermometer A	Thermometer B	Thermometer C
0	42	19	19
3	42	20	19
6	43	21	19
9	46	23	19
12	50	24	19
15	54	25	20

(a)

(i) Use the data in the table to calculate the percentage change in temperature in Thermometer **A** between 0 and 15 minutes. Give your answer to **2** significant figures.

= ..... % **[2]**

(ii) Thermometers **B** and **C** are 10 cm apart. Calculate the change in temperature per cm of sand between Thermometers **B** and **C** at 15 minutes.

= ..... °C cm^{-1} **[2]**

(iii) Suggest how **and** why the transfer of heat might be different if wet sand was used instead of dry sand in the experiment.

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(iv) Identify **three** problems that may affect the accuracy of this experiment.

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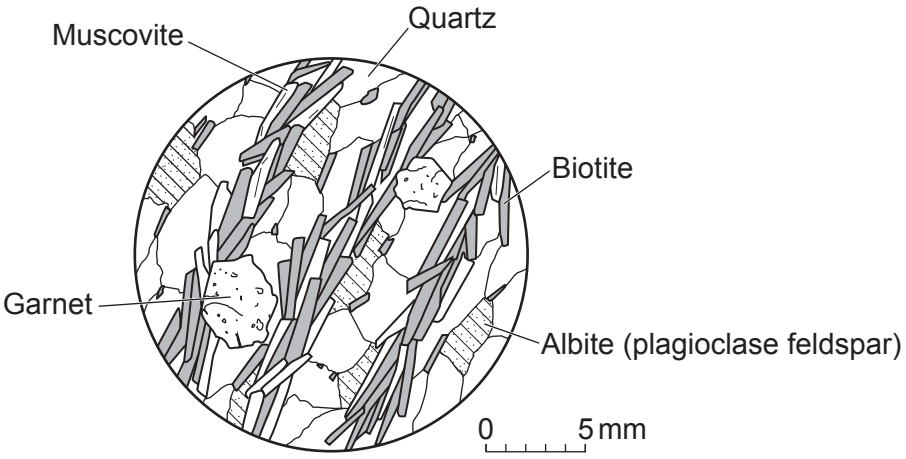
[3]

(b) The thin section diagram shows a metamorphic rock.



(i) Describe the metamorphic fabrics shown in the thin section diagram.

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(ii) **Circle** the rock type which most closely identifies with the thin section diagram.

gneiss	**metaquartzite**	**marble**
schist	**slate**	**phyllite**

[1]

(iii)* Explain how the mineralogy and texture shown in the thin section diagram indicates the conditions of metamorphism.

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Extra answer space if required.

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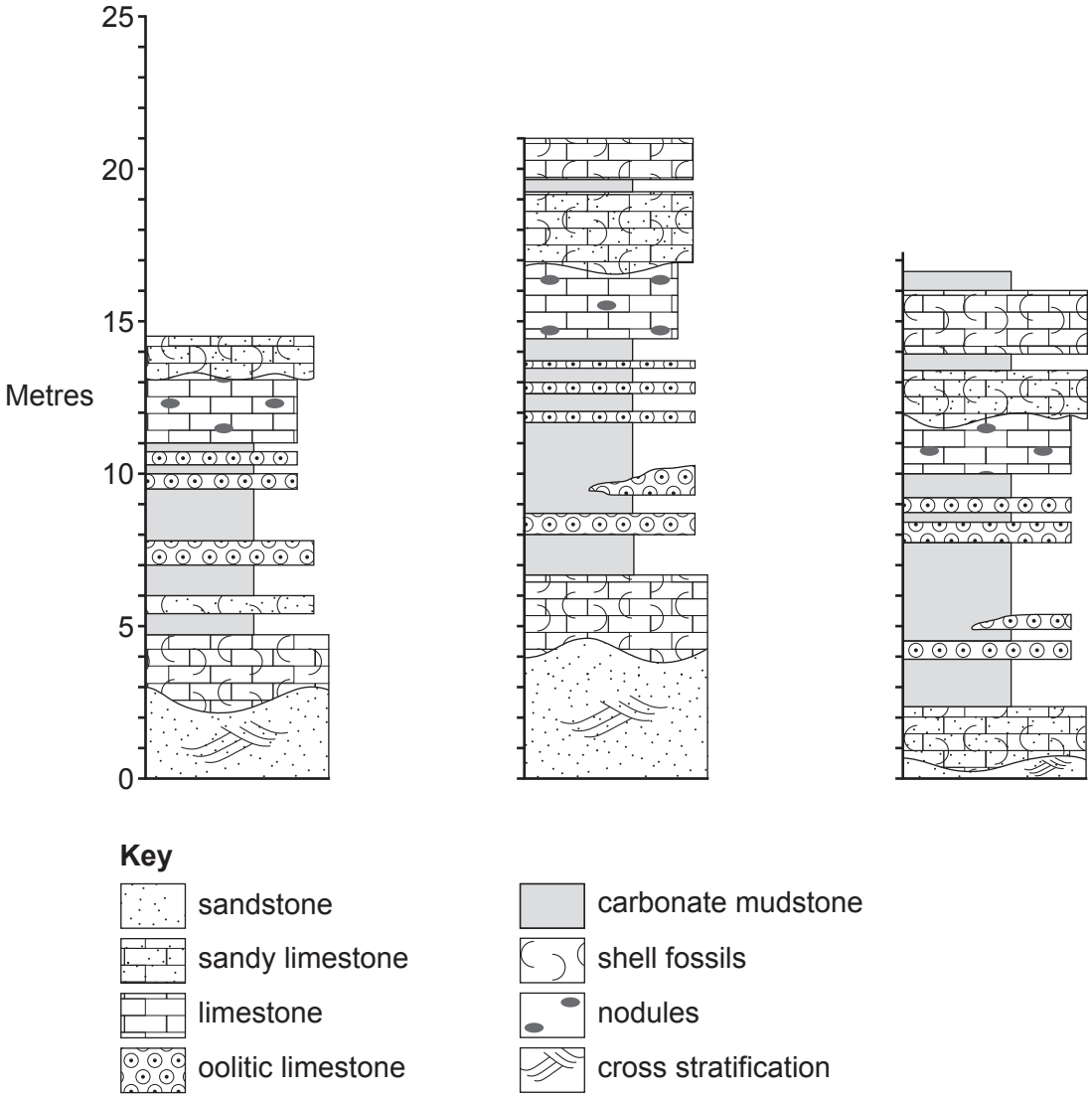
(a) The diagram shows summary sedimentary logs taken by a student through part of the cyclic Upper Jurassic sequence in the UK.



(i) Draw **three** lines between each of these sequences to correlate them using lithostratigraphic methods.

[2]

(ii) The rocks were correlated using biostratigraphy and it was noted that this did **not** match the lithostratigraphic correlation. Explain the reasons why this could occur.

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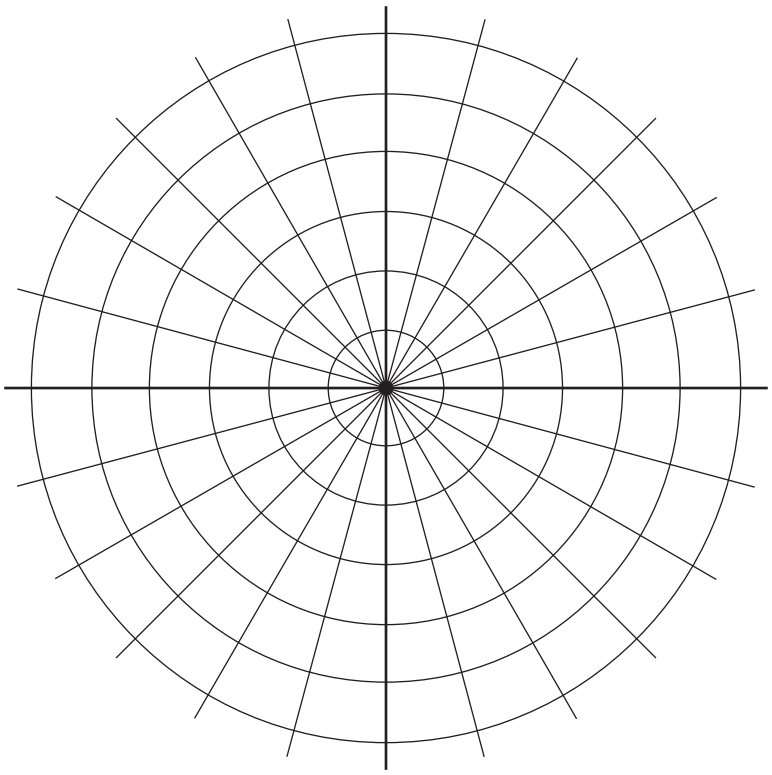
(b) Field data was collected from some Lower Jurassic rocks containing belemnite fossils. **Fig. 3**, in the **Insert**, shows part of a bedding surface containing belemnites.

Students measured the long-axis orientation of 135 belemnites on this bedding surface. The data is recorded in the table.

Orientation (°)	Frequency
001–015	0
016–030	0
031–045	5
046–060	32
061–075	60
076–090	20
091–105	10
106–120	8
121–135	0
136–150	0
151–165	0
166–180	0

(i) Plot the results from the table on the rose diagram outline.



[2]

(ii) State the palaeocurrent direction you have plotted on your rose diagram.

Explain how your rose diagram **and Fig. 3**, in the **Insert**, could provide information about the palaeocurrents.

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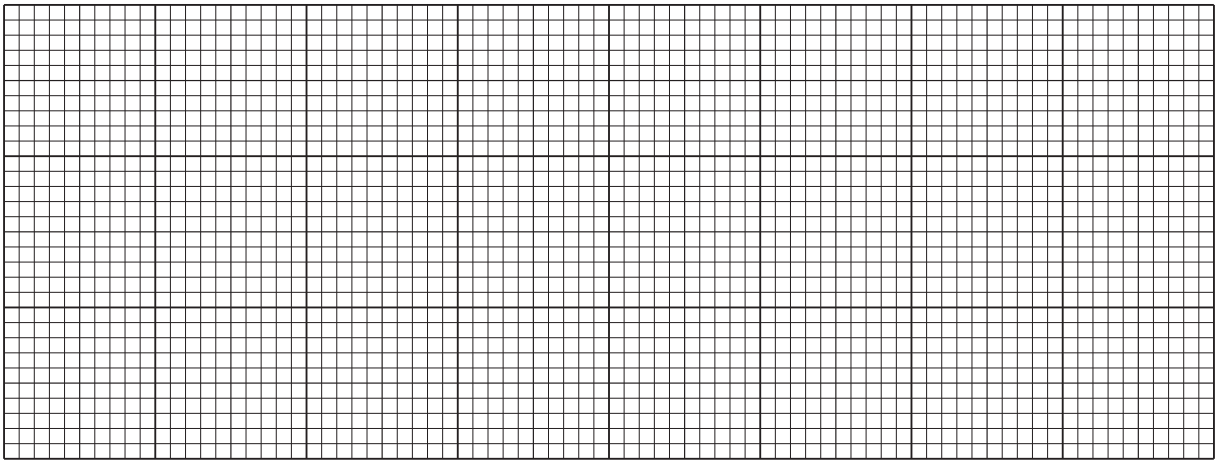
(iii) Students also measured the long axis length of the same 135 belemnite fossils on the bedding surface in **Fig. 3**, in the **Insert**. Their results are shown in the table.

Length (mm)	Frequency
0–10	0
11–20	0
21–30	0
31–40	5
41–50	15
51–60	17
61–70	37
71–80	48
81–90	13
91–100	0

Plot a histogram of the results from the table on the grid.



[3]

(iv) Describe the frequency distribution shown on your graph.

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(v) Use the rose diagram **and** frequency distribution graph you have plotted to describe the likely palaeoenvironment at the time of deposition of this rock unit.

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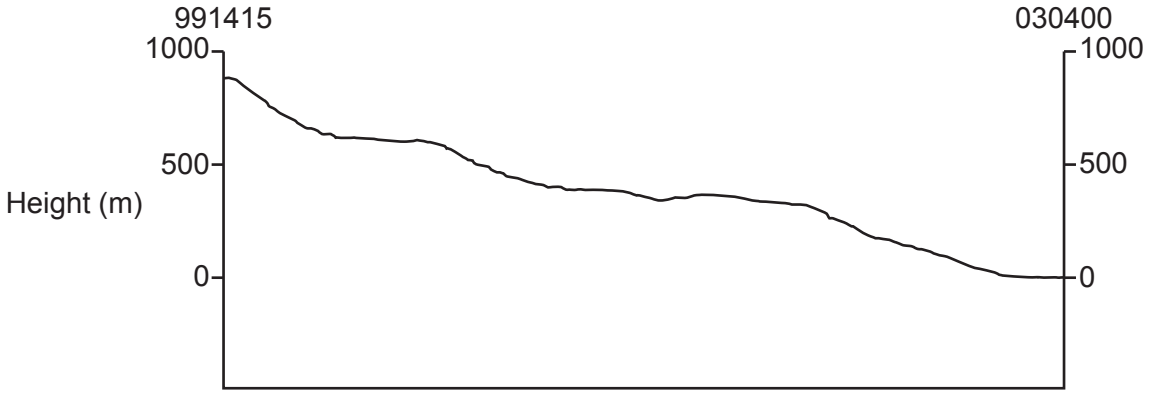
4 The 1:50 000 geological map excerpt (the Isle of Arran), in the **Insert**, should be used for this question.

(a) On the topographic sketch, draw and clearly label a cross section from grid reference 991415 in the West to 030400 in the East.



[5]

(b) Coal measures are present in the north east of the map (grid reference 022412). Suggest **two** geological problems that could affect the extraction of coal in this area.

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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.