OCR
Oxford Cambridge and RSA

Tuesday 11 June 2019 – Morning

A Level Geology

H414/03 Practical skills in Geology

Time allowed: 1 hour 30 minutes

You must have:
- the Insert (inserted)

You may use:
- a scientific or graphical calculator
- a ruler (cm/mm)
- a protractor

H414/03

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

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

First name(s) _____

Last name _____

INSTRUCTIONS
- The Insert will be found inside this document.
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Answer **all** the questions.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **20** pages.

Answer **all** the questions.

1 Four sediment samples have been collected from different environments.

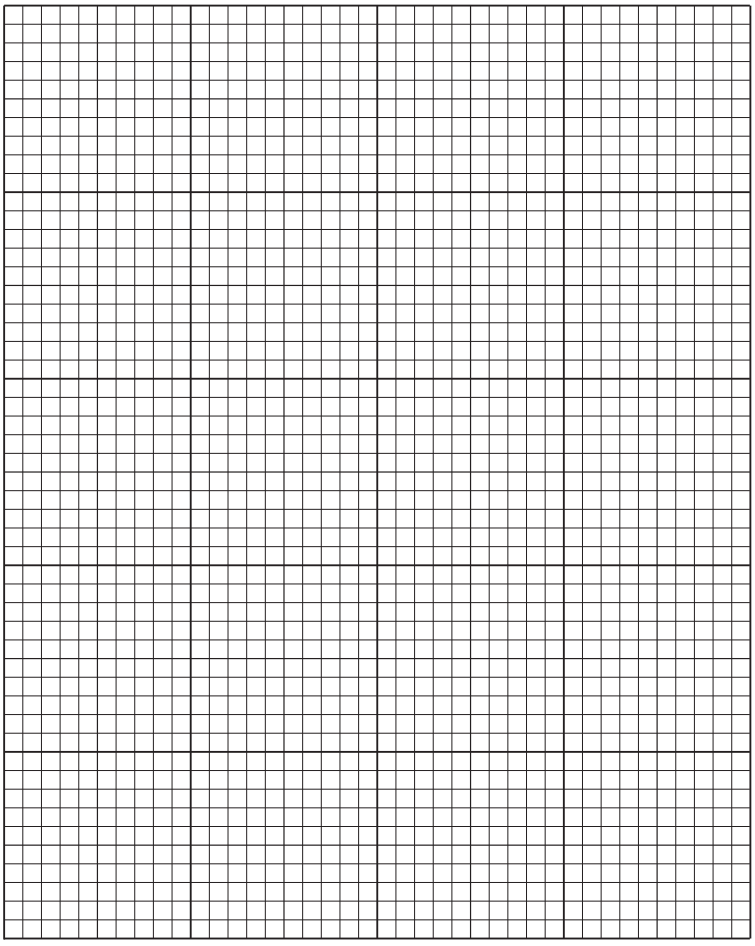
A student has analysed the sediment samples by using a sieve bank, a stack of sieves arranged with the biggest mesh (4 mm or –2 Φ) at the top and the smallest (0.0625 mm or 4 Φ) at the bottom.

The student's results are shown in Table 1.1 below.

Phi Φ	Sample A (%)	Sample B (%)	Sample C (%)	Sample D (%)
–2	11	2	0	0
–1	18	6	0	2
0	14	39	2	19
1	9	38	4	69
2	15	12	78	8
3	16	2	14	2
4	17	1	2	0

Table 1.1

(a) (i) Using the graph paper below, plot the results in Table 1.1 for samples **A**, **B**, **C** and **D** as cumulative frequency curves.



[3]

The coefficient of sorting (p) can be measured from cumulative frequency curves using the following equation:

$$\text{Coefficient of sorting (p)} = \frac{\Phi_{84} - \Phi_{16}}{2}$$

where Φ_{84} is the phi value of the cumulative mass of 84% of the sample and Φ_{16} is the phi value of the cumulative mass of 16% of the sample.

Table 1.2 shows how the coefficient of sorting can be converted into the degree of sorting.

Coefficient of sorting	Degree of sorting
< 0.50	well sorted
0.5–1.00	moderately sorted
> 1.00	poorly sorted

Table 1.2

(ii) Using your cumulative frequency curves in **(a)(i)**, calculate the coefficient of sorting for each sample. Use these values and Table 1.2 to describe the degree of sorting to complete the table. Sample **A** has been completed for you.

	Sample A	Sample B	Sample C	Sample D
Coefficient of sorting (p)	2.65			
Degree of sorting	poorly sorted			

[3]

(iii) Which of the sediment samples, **A** to **D**, is most likely to be wind-blown dune sand?

Suggest reasons for your answer.

.....

.....

.....

.....

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

2 A student is trying out several exploration methods to locate a copper deposit.

(a) Describe **one** geophysical exploration technique and explain how it could be used at the surface to help locate a copper deposit.

.....

.....

.....

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

(b) Soil samples have been collected from two transect lines, **A** and **B**, down a hill and set 1 km apart. A student has analysed the soil samples in a laboratory and has tested for the presence of copper. Their results can be seen in the table below.

Distance from top of hill in metres (m)	Copper parts per million (ppm)	
	Transect A	Transect B
0	57	55
10	61	57
20	61	58
30	61	59
40	63	61
50	65	62
60	67	62
70	69	63
80	76	64
90	820	70
100	963	76
110	1020	85
120	1180	88
130	1207	92
140	1346	94
150	1578	97
160	1610	99
Mean	606.12	
Mode		
Median		

(b) (i) Complete the table by calculating the mean, mode and median for both data sets. **[2]**

(ii) The student also performed a Mann-Whitney U-test on the data. The result clearly showed a difference between the two data sets with 99.9% significance.

Evaluate the usefulness of the mean, mode, median and Mann-Whitney U-test as statistical analyses with these two data sets.

.....

.....

.....

.....

.....

.....

.....

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

(c)* Native copper is sometimes found as placer deposits.

Design an experiment which you could do in a school laboratory which simulates the process involved in the formation of placer deposits.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[6]**

Additional answer space if required.

.....

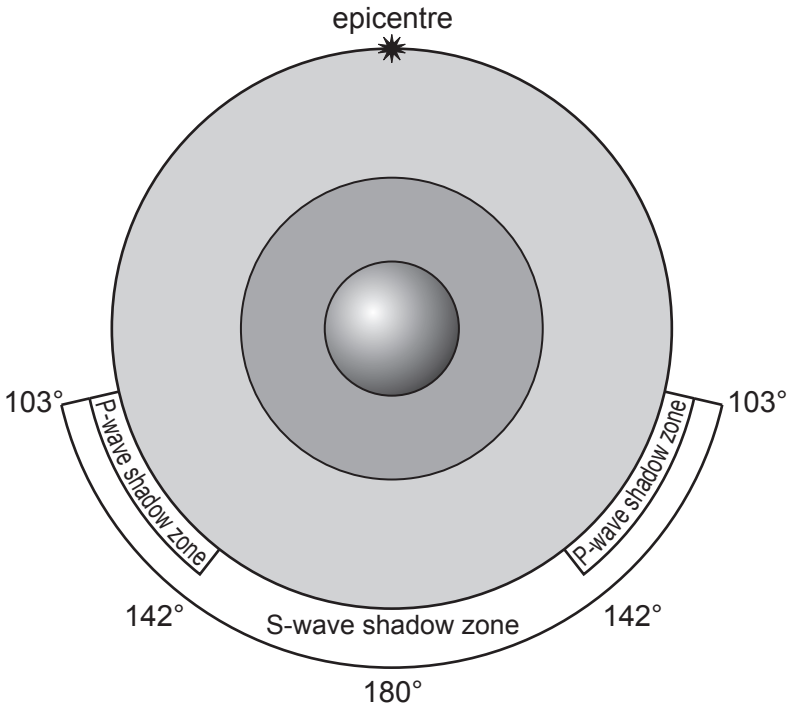
.....

.....

.....

.....

3 The diagram of the Earth below shows the shadow zones of both P and S waves after a hypothetical earthquake at the North Pole.



(a) (i) Label the following on the diagram:

- inner core
- Gutenberg discontinuity
- crust
- mantle
- outer core
- Lehmann discontinuity. **[2]**

(ii) On the diagram, draw and label a path of a P wave **and** a path of an S wave propagated from the epicentre. **[1]**

(iii) Explain why both P and S waves arrive at the Earth's surface up to 103° from the epicentre but S waves cannot be detected beyond 103° from the epicentre.

.....

.....

.....

.....

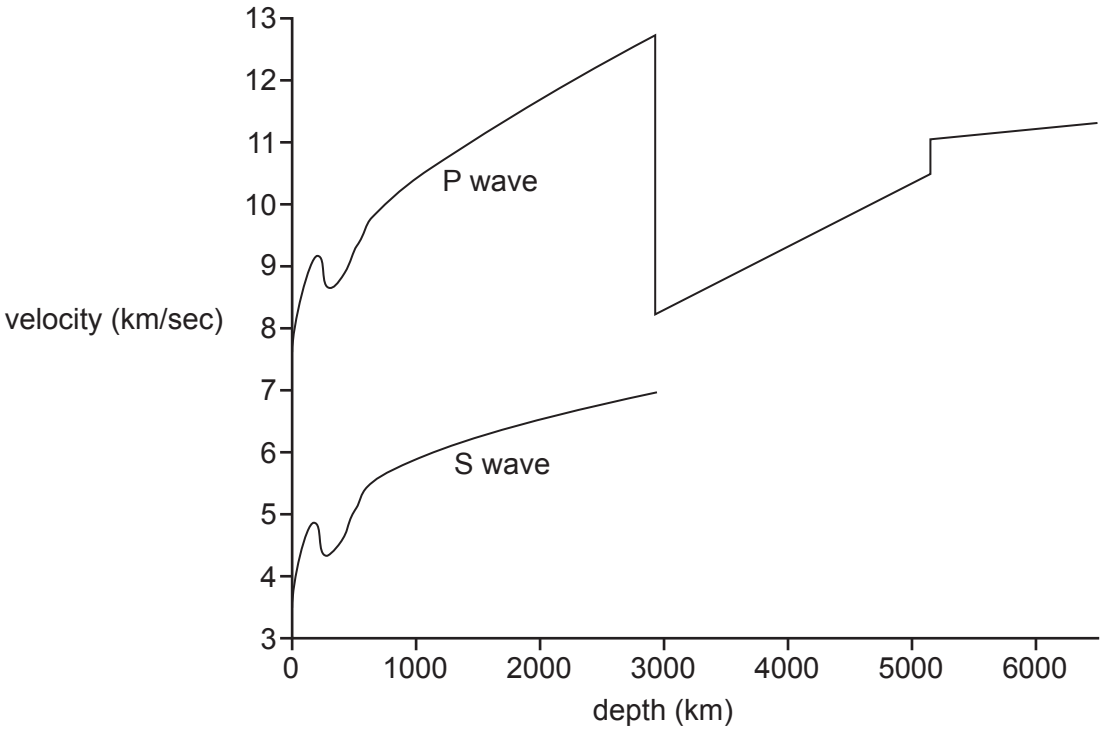
..... **[2]**

(b) In the space below, draw an annotated diagram to show how P and S waves could be demonstrated in a laboratory using a spring.

[2]

(c) The graph shows the velocity of P and S waves as they travel through the Earth, which allows us to infer the composition and state of the different layers of the Earth.

Label and annotate the graph to show your understanding of this statement.



[3]

BLANK PAGE

PLEASE DO NOT WRITE ON THIS PAGE

Turn over for the next question

4 The map in Fig. 4.1, **on the insert**, shows the simplified geology typical of an island in the Inner Hebrides in Scotland.

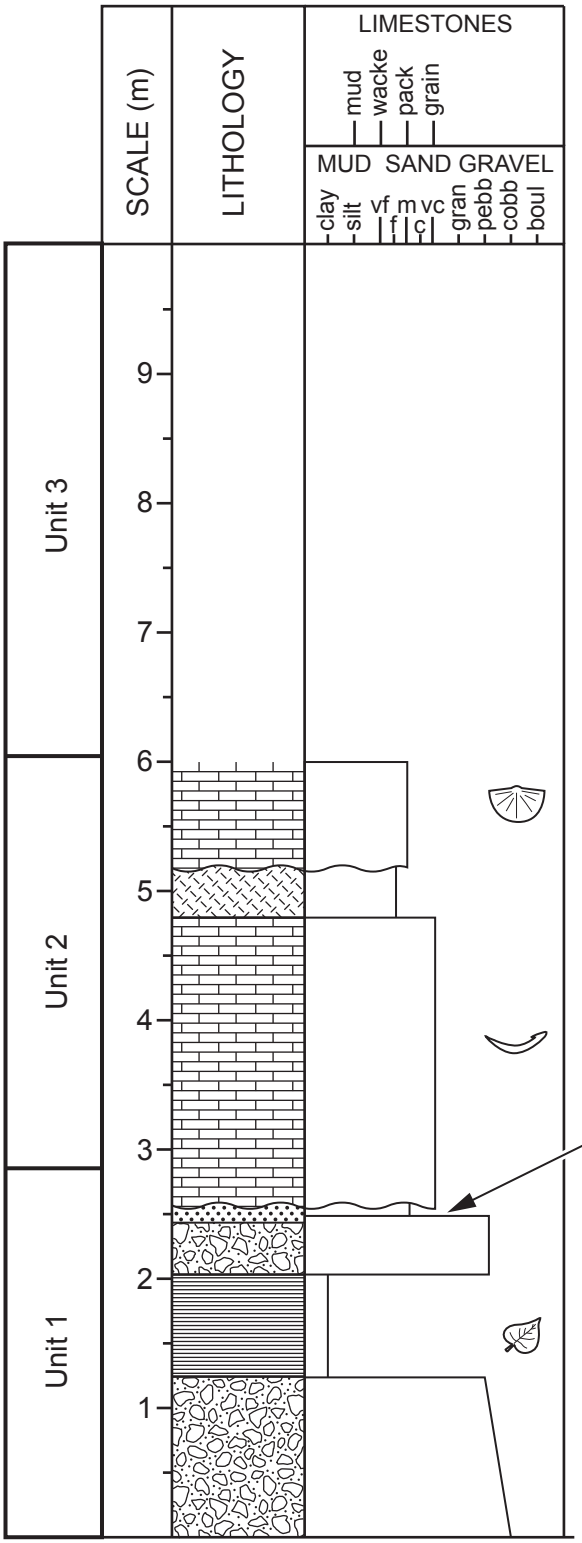
A field excursion has been undertaken at several locations on the island. The three areas of study have been labelled on the map as points **A**, **B** and **C**.

(a) Table 4.1 shows the field data recorded at location **A**. Bed 1 is found 6 m from the base of the cliff, whilst the base of bed 4 is 8.5 m from the base of the cliff.

Bed	Thickness (m)	Rock description	Features visible
1	1.50	Massive conglomerate, densely packed imbricated clasts of arkose up to 30 cm in diameter; irregular silty sandstone wedges towards the top.	Uneven base (erosional). Slight fining towards top.
2	0.20	Fine grained sandstone with sharply defined laminated base.	Parallel bedding.
3	0.80	Massive conglomerate, densely packed imbricated clasts of arkose up to 30 cm in diameter.	Slight fining towards top.
4	0.50	Highly amygdaloidal basaltic lava forming the top of the cliff.	Amygdales present towards the top.

Table 4.1

(i) Using the data in Table 4.1, complete the graphic log on page 11, including summary rock descriptions. **[3]**



Description

Massive limestone, finer grain size with whole fossil remains. Igneous fragments found at base.

Igneous formation, reddish-brown upper section with some vesicles at the top. Finer crystals at the base.

Massive limestone. Large grain size. Shell fragments present. Evidence of a contact zone at the top (baked margin).

Sandstone with some larger particles present.

Conglomerate with a sandy matrix. Clasts 10–15 cm.

Shale with some plant remains present.

Massive conglomerate with well-packed and well-rounded pebbles and cobbles. Some evidence of basaltic and granitic cobbles. Clasts up to 30 cm but more commonly 10–15 cm.

Lithologies

- Conglomerate
- Shale/Clay
- Sandstone
- Limestone

Symbols

- Plant material
- Broken fossil shell fragments
- Complete brachiopods

Base Boundaries

- Erosion
- Sharp

Other

- igneous rocks

(ii) Use the space below to draw and label an imbricate structure which could be found in Unit 3 of the graphic log.

[1]

(iii) Explain how it is possible to calculate the direction of water movement using the imbricate structure.

.....

.....

.....

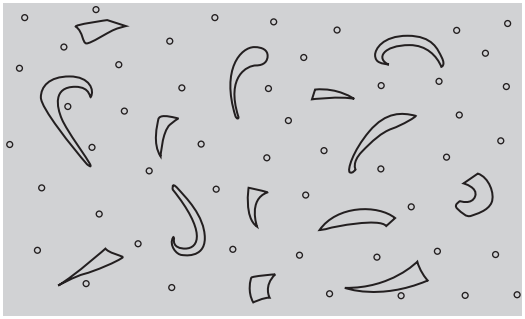
.....

.....

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

(b) The diagrams in Fig. 4.2 show field sketches of the fossil assemblages found at location **B** on the map in Fig. 4.1.

Assemblage **X** – Coarse grained limestone



Assemblage **Y** – Fine grained limestone

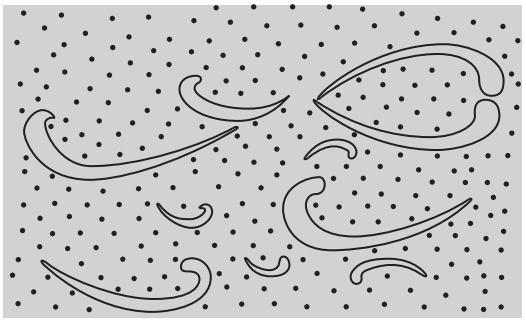


Fig. 4.2

(i) Which of the diagrams, **X** or **Y**, indicates a death assemblage?

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

(ii) Describe the factors that can affect the quality of fossil preservation and how this can help to determine the palaeoenvironment.

.....

.....

.....

.....

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

(c) **(i)** Identify the igneous feature described within Unit 2 of the graphic log.

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

(ii) Describe **two** features you would look for in the field which would allow you to identify this igneous structure.

.....

.....

.....

.....

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

(d) Location **C** on the map in Fig. 4.1 shows an area of metamorphic rocks. Units of both shale and limestone have been metamorphosed following the emplacement of the igneous intrusion.

Outline the changes that take place in the metamorphosed shale and limestone.

.....

.....

.....

.....

.....

[2]

(e)* The photograph in Fig. 4.3 shows some different rocks found on a nearby island.

Using the information shown in the photograph, identify the rock type and explain how the rock formed. **[6]**

Fig. 4.3

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Additional answer space if required

.....

.....

.....

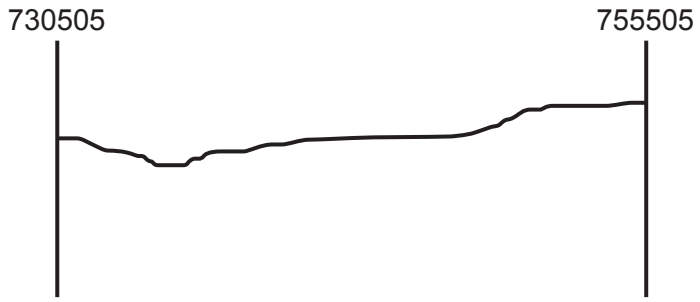
.....

.....

Turn over for the next question

5 The 1 : 50 000 geological map excerpt (Worcester), **on the insert**, should be used for this question.

(a) On the topographic sketch profile below draw and label a cross-section of the solid geology from grid reference 730505 in the West to 755505 in the East.



[4]

(b) (i) Evaluate the fault types and directions that occur within the Coalbrookdale Formation and Much Wenlock Limestones in grid square 730510.

.....

.....

.....

.....

.....

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

(ii) A quarry company have applied for planning permission to site a quarry in the Wenlock Limestone, at grid reference 732512. The overall size of the quarry would cover around 1 km^2.

Analyse the potential geohazards that may occur around the area of extraction.

.....

.....

.....

.....

.....

.....

.....

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

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).